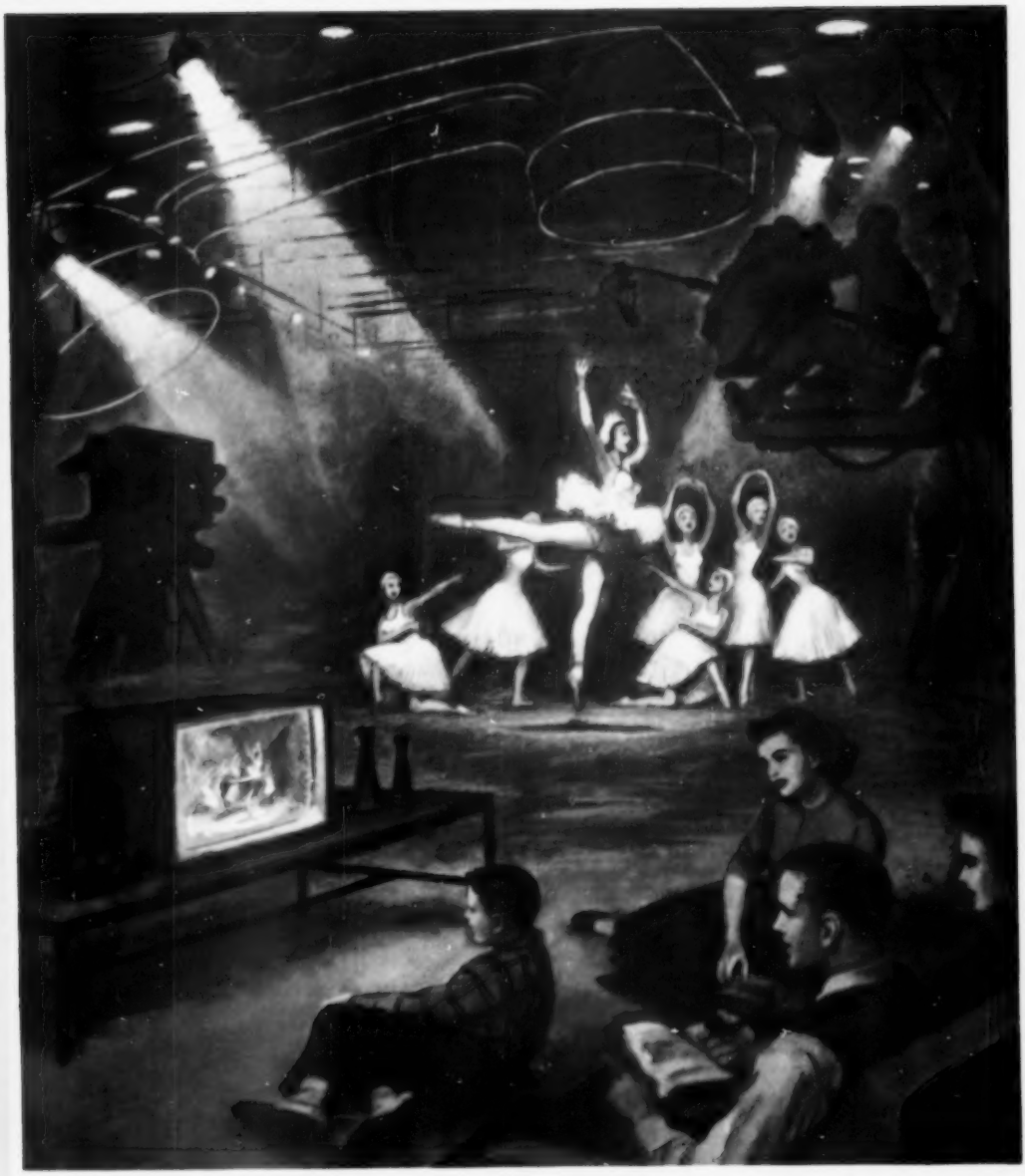
Bell Telephone MAGAZINE

WINTER 1955-56



VOLUME XXXIV NUMBER FOUR WINTER 1955–56

Bell Telephone Magazine

A non-technical review, published quarterly to give Bell System management people a broader view of the history, objectives, operations, and achievements of this business than they might attain in the course of their day-to-day occupations, and an added sense of participation in the problems and accomplishments of our nation-wide public service.

A MEDIUM OF SUGGESTION and A RECORD OF PROGRESS

Cover: The Bell System and Television. Painted for this Magazine
Charles Mazoujian

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JUDSON S. BRADLEY, *Editor* SALVATORE J. TAIBBI, *Art Editor*

Published for the Bell System by the Public Relations Department, American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.

CLEO F. CRAIG, *President* S. WHITNEY LANDON, *Secretary* JOHN J. SCANLON, *Treasurer*

Who's Who & What's What

IN THIS ISSUE

SINCE JULY OF 1951, CLEO F. CRAIG has been President of the American Telephone and Telegraph Company. His Bell System career, beginning in 1913, illustrates how broad may be a man's experience within one organization. For his assignments in the Long Lines Department took him from St. Louis to Kansas City and Atlanta en route to New York, and to such diverse posts as district plant chief, plant accountant, and construction supervisor, among others—with a six-year interval as a special representative in the A. T. & T. General Department—before he became general manager of Long Lines in 1933. He was elected Vice President in charge of the Long Lines Department in 1940, and the following year moved to A. T. & T. headquarters. There his vice-presidential responsibilities included, in turn, charge of the departments concerned with Personnel Relations, Operation and Engineering, and Finance and Revenue Requirements.

Cleo F. Craig

Major General Gordon A. Blake

The foregoing is reprinted from this MAGAZINE of just a year ago, in which was published Mr. Craig's "Big Business and the Community." At the beginning of 1956, it still seems appropriate as a brief statement of an outstanding telephone career.

GORDON A. BLAKE was born in Charles City, Iowa, in 1910, and lived there until 1927.

Will Whitmore, right, with narrator John Nesbitt

He was graduated from the United States Military Academy in 1931, and from advanced flying school a year later. After a tour of flying duty, he completed the Signal School, Fort Monmouth, N. J., and became a communications instructor at Chanute Field, Illinois. General Blake served overseas in Hawaii and Alaska during the period 1939–1945. Upon return to the Zone of Interior he served successively as Deputy Commander, Airways & Air Communication Service, student at the Air War College, with the Electronics (Engineering) Division and Armament Laboratory at Wright-Patterson AFB, and Vice Commander of the Wright Air Development Center. He became Director of Communications—Electronics, Headquarters USAF, in February 1953. Major General Blake has been awarded the Silver Star, the Legion of Merit, Navy Legion of Merit, Distinguished Flying Cross, and Air Medal during his career.

A FREE-LANCE WRITER on business subjects and then a staff writer on a trade journal, from 1922 to 1929, WILL WHITMORE joined the Public Relations organization of the Western Electric Company in the latter year. There he became advertising supervisor in 1935 and advertising manager 10 years later. It was in 1948 that he moved to A. T. & T's Public Relations Department as radio advertising manager. The expansion of his duties is indicated by the changes in title: radio and exhibit manager in 1952, and now the inclusion of "TV"—as shown at the head of his article. While he does not really commute between New York and Hollywood, he has taken advantage of the hours required by his frequent journeys recently between the two coasts to put down on paper his present contribution. He is shown here with John Nesbitt, who will be the narrator on the A. T. &. T.'s TV program.

THE PREVIOUS ISSUE of this MAGAZINE, with its very full accounts of last Autumn's hurricanes and floods, gave JAMES W. COOK an opportune text on which to base this issue's "guest editorial." Perhaps some of our readers, when next they hear of the quick and efficient restoration of telephone service after some catastrophe, will have a broader understanding of all the factors

(Continued on page 283)

James W. Cook

ON THE WAY TO THE DEW LINE

Ships of the Military Sea Transportation Service passing through ice fields as they carry building equipment and supplies for the construction of the Distant Early Warning net across the top of the world.

"Progress means that you are extending the sense of responsibility to those who lacked it before and are deepening it in those who have it already"

EQUIPPING OURSELVES FOR TODAY'S RESPONSIBILITIES

CLEO F. CRAIG

President, AMERICAN TELEPHONE AND TELEGRAPH COMPANY

At the annual dinner of the Alumni Society of the Wharton School of Finance and Commerce in Philadelphia on November 14, the society's Gold Medal of Merit was presented to Mr. Craig as the man who has made the "greatest contribution to American business" during 1955. After a brief greeting, Mr. Craig addressed the following remarks to his several hundred listeners:

YOU HAVE MY deepest appreciation for the honor signified by this award. I feel sure that in presenting it, you are also recognizing the contribution made by all the people of the Bell Telephone System to our community and national life. For them as well as for myself—thank you so much.

If you don't mind, I'm just going to talk along informally, and I'll begin by mentioning two projects that telephone people are working on, as they seem to lead naturally into the rest of what I want to say. One is the new transoceanic telephone cable, the first ever to be laid, which we expect will be ready for service between this continent and Great Britain about a year from now. The other is the so-called Distant Early Warning Line in the Arctic, where a picked team of Bell System men is installing a chain of radar stations that will give us warning of any air attack that might come from over the top of the world.

The job in the Arctic is being done at the request of the United States Air Force by a group drawn from telephone operating and manufacturing units and from our research laboratories. The transatlantic cable is a joint project of our company and of communication agencies of the British and Canadian governments.

Last June when the cable-laying started, going east from Newfoundland, I had the privilege of being aboard ship. It is quite an experience to watch a cable that has behind it perhaps a quarter of a century of work settle in the Atlantic at six knots an hour, and to see, every 40 miles or so, an amplifier or voice booster that has been

built into the cable structure with the most painstaking care slip under the waves. As you see it go down, you know that at that very moment, the vacuum tubes within the amplifier are alive with energy, and that for the next twenty years or more they will be giving fresh life to voice currents so that human speech will travel the depths of the ocean strong and clear.

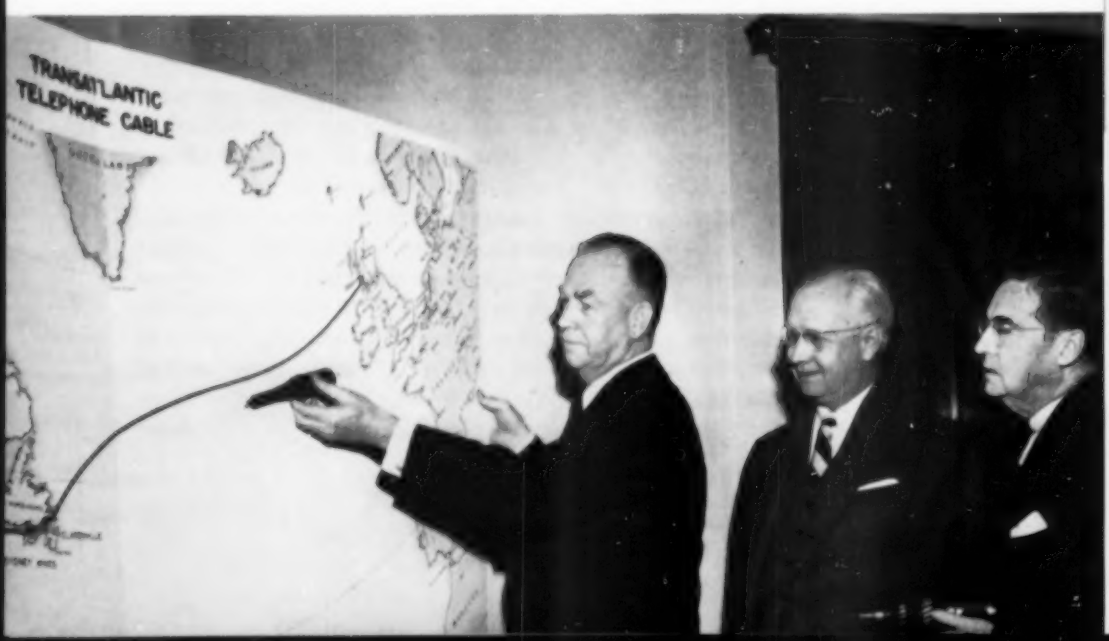
Also, while I was on the ship, I couldn't help thinking of the good spirit which had made the cable possible. As each foot dropped behind us, part of it was British, part was American, and part was Canadian. All of it told of joint interest and joint effort, and all would contribute to joint well-being.

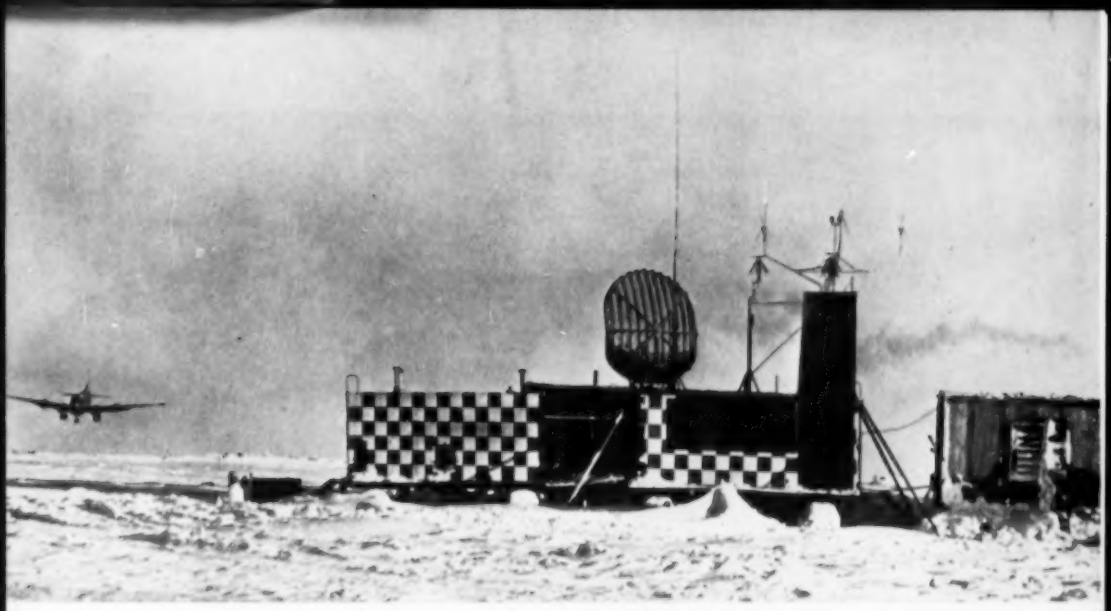
I have not had an opportunity to visit the work in the Arctic on the Distant Early Warning Line, but from talking and listening to the men who are managing the job I feel almost as though I had been there. The line of radar stations will reach for more than 1,500 miles, all the way across the northern rim of this continent. From each station, communications will be to other stations in the chain and to the rear—to our neighbors in Canada, and to ourselves. The purpose of the whole enterprise is simply to give us a few hours' warning of danger on the wing, a few precious hours in which we may prepare our defenses.

What I have just said may make the far north seem rather near at hand, but when you look at maps and pictures you get a very keen sense of distance and remoteness. Up there on the ice—and some of the country is terribly rugged—men and instruments will keep watch day and night and through all kinds of bitter Arctic weather.

To establish each post—and there are many of them—a long and carefully organized sequence of work is required. First, for example, surveying and locating the sites. Then the first landings, in small planes equipped with skis. Then bigger planes that can bring in tractors. Then all the thousands of tons of materials for housing, engines and fuel, food, and other supplies. Then the construction work itself and, finally, the arrival, installation, and testing of radar equipment.

"*. . . the first ever to be laid, which we expect will be ready for service between this continent and Great Britain about a year from now.*"





". . . where a picked team of Bell System men is installing a chain of radar stations that will give us warning of any air attack that might come from over the top of the world."

You almost have to pinch yourself to realize that the communication art, and many other technical skills as well, have progressed to the point where such an installation is possible. Only a few years ago it could not have been done.

The implications of this Arctic job are quite different from those of the transatlantic cable. The cable is important from the standpoint of security too, but it speaks most eloquently of international friendship and good will. The warning line is a sort of sentinel that will ask "who goes there?" Behind one is trust. Behind the other, distrust. Yet both are alike in helping us to realize the profound effect of modern communication services on all our lives.

TODAY WE CAN HEAR MORE, see more, know and understand more of the world and its people than was ever possible for human beings before. Fast and abundant communications also help us to accomplish more and produce more. Thus technical advance keeps opening the way to new social gains.

At the same time, however, it presents us with new risks and responsibilities. For instance, every kind and shade of opinion can find wings today. Pressure groups can raise a greater din than they ever could in the past. The average man or woman nowadays is exposed to the heaviest barrage of good and bad ideas, arguments and solicitations, that has ever been fired, and the ammunition seems inexhaustible. Freedom of communications is vital, but it can also be confusing. If we are not going to be led by the nose, we have to think, study, balance, and choose. And most important, we have got to develop the breadth of mind to do this.

In this and other ways, technical progress seems to keep asking more of us. Many people today have misgivings about the onrushing pace of science and technology. This momentum is enormous, and there's little doubt in my mind that it will change the world even faster in the years ahead.

I can't hold, however, with those who are alarmed at the prospect. To me the opportunities are breath-taking and worth

". . . everlastingly operate for the good of the community. The community can't ride one track and business another. The two are inseparable, interactive, and interdependent."

all the effort they call for. I have real faith that we will equip ourselves to meet them. But in order to do so, I am altogether convinced that we in industry must first measure and understand what our responsibilities really are. We have to learn them, we have to accept them, and we have got to acquire the knowledge and the discipline we need to discharge them well.

More than any civilization of the past, our modern industrial civilization relies on the free good will of men and women. We in this country have enjoyed the greatest degree of freedom and we have also advanced farther in industry. This is certainly no coincidence. The two go together.

But it is no coincidence either that our combination of freedom and industry has now brought this nation to a new place of responsibility in the world. If ever in the past it was necessary to argue the relation between the free and the responsible, it is no longer necessary now. We read it in the headlines every day.

What is true in international affairs can hardly be less true at home. No one can accept responsibility in the world unless he takes it first on his own doorstep. So for us in industry I can see only one sure course to follow. Call it common sense, call it policy, call it anything you like. To my mind industry must aim for, exist for, and everlastingly operate for the good of the community. The community can't ride one track and business another. The two are inseparable, interactive, and interdependent.

I HOPE you don't think this is just visionary talk. I am quite aware that business is also a way of making a living. No business can succeed in serving the public well unless it succeeds financially and the people in it obtain reasonable rewards. I realize that the

pulls of self-interest are very strong, and furnish valuable incentives of their own. But let me ask this question: Ought not a sincere concern for the common welfare—the desire to help build the best possible community—shouldn't that be as much the goal of a business as it is of this Wharton School which for nearly 75 years has been training businessmen? I surely think so. Or I'll put it another way. Should we divide our population up in some manner between those who pursue the aims of business and those who want to work for the good of society? Who would say yes to that?

Certainly we in business management are trustees for our share owners. But in the world we live in—and I don't want any other—I believe we can only be good trustees for the share owners by fulfilling our trusteeship of service to the public. To me it is not conceivable that this nation, facing the tasks which confront it today, will be content with anything less.

Furthermore, we in management have found great value in encouraging the widest possible sharing of responsibility at all levels in the organization, and this can only be brought about when people feel they have a truly satisfying motivation—the most, not the least; financial reward certainly, but not that alone. The more we learn of human behavior, the more we find that human beings really do want to devote themselves to worthwhile goals. To nourish an individual's desire to grow, we in industry must help him find goals that he feels are worthy of his best efforts.

I agree that this is more a matter of creating a climate than of furnishing a map. And I don't worry too much about this kind of business policy tending to produce a type. A person is not necessarily less of an individual because he happens to share certain qualities with others. In fact, if he doesn't share at least some of them, no one is likely to want him around.

To some extent any institution, whether it happens to be a busines or a university, puts its stamp on the people in it. If the identifying mark tells of imitative thinking and mere conformity, that of course is not good. But if it is the broad mark of sharing in a joint endeavor, a common effort to really serve the community with the best one has to give, I don't care how many people I see wearing it. In that sort of association there ought still to be plenty of opportunity for everyone to grow individually as his talents permit.

Our problem is—as working men and women always busy with the day-to-day job—how can we do the most, and what activities will most reasonably help us, to become bigger people, with better understanding of social and public affairs—men and women broader in outlook, and thereby better able to see the ultimate as well as the more immediate effects of the decisions we are called on to make?

As one answer to this, it seems to me that everyone who shares the responsibilities of industry will gain at least something worth while from the deliberate effort to study the relation between his own work, the work of others, the activities of government, and the well-being of the community: to do this objectively and, in so far as possible, through participation in a group.

We used to hear the word "isolationism" applied to a large body of thinking in the United States. We don't hear it much any more, for the simple reason that it is no longer possible for us to isolate ourselves from world affairs. No business can be isolationist any more either. What other industries are doing affects us, what we do affects them, and government affects us all.

We have no choice but to learn and try to understand other points of view, to study public opinion, and do our best to contribute intelligently to it.

IN MODERN INDUSTRY our resources for this kind of study are considerable. But I would be pretty sure that we will never be self-sufficient. I am glad, therefore, that the colleges and universities are offering a wide range of opportunities for management training and education. Most of the time there are quite a number of telephone people going to school in institutions across the country, and I am confident they are gaining much from the experience.

At the same time, the telephone companies are carrying on various educational programs of their own, in addition to purely vocational training. One part of our effort which I want to mention particularly is what we call the Bell System Executive Conference. I've talked a bit about this before, and if some of you have heard me I ask your indulgence for the repetition. Through these Executive Conferences we have brought together some 800 or more high-ranking people in the Bell companies in groups of 40 to 50 spread over a period of a little more than two years. They have lived, studied, and talked out problems together during four-week sessions. The speakers are often from fields other than business—the very best people we can bring in, with many different backgrounds. These talks by guest speakers always lead to questions and free discussion. I have met with most of the different groups and they have really given me a going-over.

But this program was conceived as a

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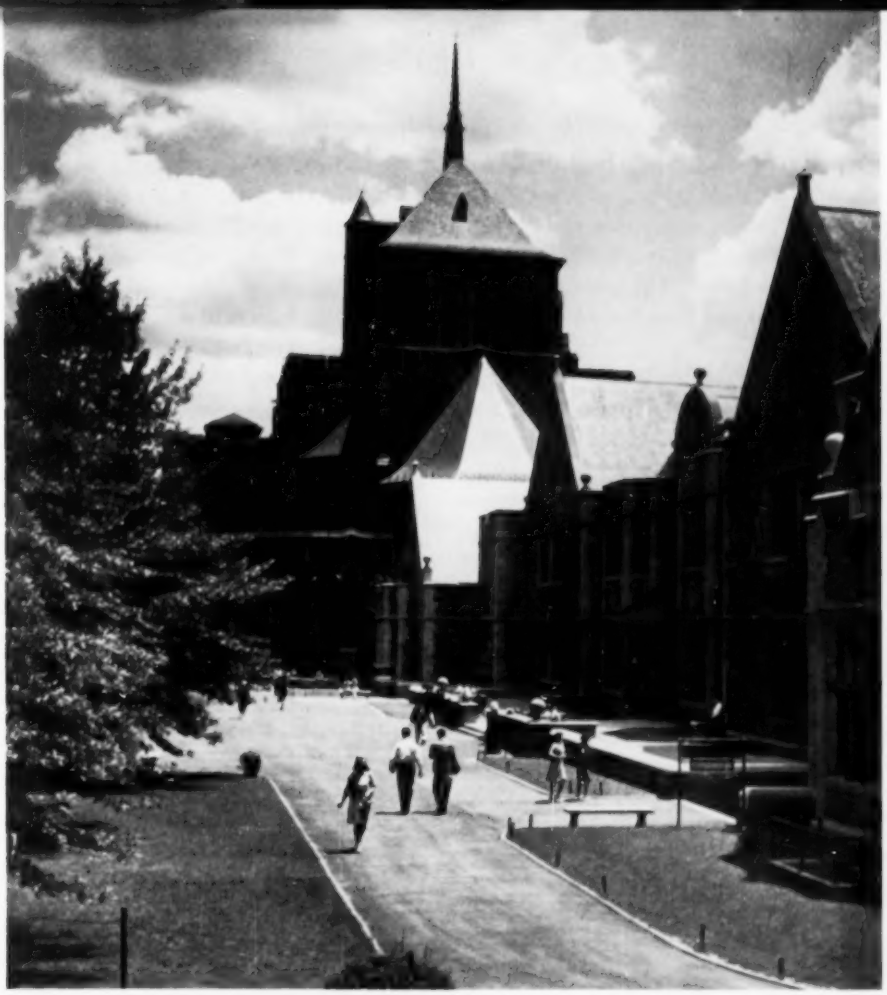


"Most of the time there are quite a number of telephone people going to school in institutions across the country. . . ."

starter only. This fall we are beginning a second series of meetings as a follow-up to the first series. We have also said to these men, who come from all over the country, "We hope when you go back home you'll see what you can do to get this kind of thing started in your own territories." And they are beginning to go ahead with their own programs. Truly I think they will have to, for of three things I am convinced. One is that success in business management, at least in a large business, depends on a wise distribution of decisions. The second is that decisions which will best serve both community and company interests have to be based on genuinely broad considerations. The third is that any company that is going to be run this way must do all it can to help its people grow in outlook and stature.

Here at this meeting I can't fail to speak briefly of another activity we are carrying on through the cooperation of the University of Pennsylvania. This is the Institute of Humanistic Studies, which was started by the University in the fall of 1953 at the

suggestion of Mr. Gillen. The third session is now in progress, with 24 men from various Bell System companies taking part. About the same number attended last year and the year before. The course begins in early autumn and runs continuously until June.

This is an unusual experiment, organized to test the idea that a concentrated program in the liberal arts given to a promising man at the threshold of his mature years will significantly increase his executive potential and his stature as a man.

Will it do so? No one can answer that question now, but as time goes along we shall see. I will say this today: I am thoroughly glad we are making the experiment; and may I just say to Dr. Harnwell and to all his associates who are doing so much in our behalf—we are deeply grateful.

And now let me come to the end of my remarks in this way:

Years ago I read with great interest a book on constructive citizenship by L. P. Jacks, then principal of Manchester College, Oxford. The other day I took it down from the shelf and browsed through it again. If you have read it, perhaps you will recall these words which sum up much of the author's thought:

"Society advances by extending the area of responsibility of its members. Progress means that you are extending the sense of responsibility to those who lacked it before and are deepening it in those who have it already."

This idea, it seems to me, offers much to all of us and I quote it here as a sort of concluding text for everything I have said.

You have been very kind in listening. Thank you for that, and again let me express sincere appreciation for the honor you have extended to me, and also, as I believe, to the men and women of the Bell System.

The SAGE System is explained as that portion of the air defense system which provides the means for the semi-automatic processing of data and weapons control

OUR AIR DEFENSE SYSTEM

MAJOR GENERAL GORDON A. BLAKE

Director of Communications, HEADQUARTERS, UNITED STATES AIR FORCE

SINCE WORLD WAR II, this nation has built up a new kind of peacetime economy. It is an economy which devotes over one-half of the Federal budget to military defense. Never before in the nation's long and prosperous history has so much money been devoted to defense in time of peace.

The American taxpayer has borne the high cost of this policy without complaint. The public, however, has an interest in what this cost is buying in terms of our military strength. The Department of Defense would like to report more information to the public more often. But we are frequently restrained by security considerations. The very defense we are all working together to create can be damaged by unwise or untimely releases of information.

One of the prime benefits, however, in publicizing and explaining defense problems is that it helps to secure cooperation from people in all walks of life. And one of the important things we need in our air defense system is cooperation from the average individual citizen. After all, one of the prime purposes of the air defense system is to save the civilian population. Hence, it is particularly important that the average person take an interest in this system, and devote effort aggressively to learning his part in it.

I can tell you a little bit here tonight of just what the Department of Defense is doing to give you the best air defense system in the world. We know that this can be accomplished by making the system as automatic as possible, because it has become evident that some type of reliable, automatic operation is necessary to achieve the speed and efficiency the job calls for.

A good deal of this automatic operation is wrapped up in a project called SAGE. While this term is not completely strange to many of you—since it has appeared in various press releases—I suspect that some of you may share the misconceptions about SAGE which have resulted from fragmentary comments on the subject. This talk will be, in effect, a report to you on SAGE.

A speech before the Armed Forces Communications and Electronics Associations in New Haven, Connecticut, on October 27, 1955. Copyrighted by and reprinted with the permission of that Association, publishers of *Signal*.

A landing craft fends off an ice floe from one of the ships engaged in transporting supplies for the Dew Line operation.

First, what does the word SAGE mean? It is actually a short title derived from the words Semi-Automatic Ground Environment. The *Semi-Automatic* part is more or less self-explanatory, since it relates to the techniques employed to handle information. However, the *Ground Environment* part is a bit ambiguous. This is a term coined by the Air Force to describe the complex of electronic equipments installed at ground locations and used to provide some sort of operational service. In the case of SAGE, the operational service being performed is the handling of large volumes of information or data in solving air defense problems. In short, SAGE is a project for improving our air defense by applying semi-automatic operation to our handling of information and the direction of weapons. It is not a new air defense system but rather a major improvement in the one we already have built and are operating today.

The need for semi-automatic operation becomes evident when you consider the great volume of flight information pouring into the system. This over-all volume possibly is as great in peacetime as in wartime. All aircraft flights must be watched and identified by the defense system. There are 30,000 scheduled flights per day, plus a great many more unscheduled. Information about these flights is fed to our defense system from 13 sources. Many of these sources are completely operational. Others are rapidly being developed and expanded.

The first is the heavy surveillance radars within the United States.

The second is the heavy height-finder radars. Height-finders are necessary be-

cause most surveillance radars do not give altitude.

Third, there are small gap-filler radars, between the large radar, to cover the gap which large radars cannot see.

Fourth, for civil aircraft, flight plans and other information are relayed from the CAA flight service centers.

Fifth, for military aircraft, similar information is relayed from the Military Flight Service.

Sixth, there is the Pine Tree line. This is the name given that part of the United States radar fence which laps over into Canada.

Seventh, there are our early warning lines. One is the Mid-Canada line, which extends across Canada from British Columbia to Newfoundland. The other is the DEW Line (Distant Early Warning) which extends across the top of Alaska and Canada. Plans for the arctic line were the subject of a joint Canadian-American announcement in September 1954. Overcoming the rigors of the arctic to establish the DEW Line has been one of the most dramatic accomplishments of the radar extension program.

Eighth, there are radars in southern Alaska.

Ninth, there are Navy picket ships along the Atlantic and Pacific coasts. These floating radar islands extend the land-based radar coverage for hundreds of miles out to sea.

Number ten, supplementing the coverage at sea are the Constellation AEW&C aircraft (Airborne Early Warning and Control). These giant aircraft are actually flying radar stations, each carrying five tons of electronic equipment and a crew of 18 men. They greatly expand the "seeing" coverage of the air defense system. AEW&C planes not only patrol a great area, but they can lift radar several miles in the air to scan a much greater line-of-sight distance.

The eleventh source of information for SAGE is the radar on man-made islands anchored to ocean shoals off the Atlantic seaboard. These are called Texas Towers because they resemble oil derricks in the Gulf of Mexico.

The twelfth source of information is the Ground Observer Corps, the GOC. This is made up of thousands of average citizens who volunteer and donate their time to watch the skies a few hours a week. Radar can see through darkness and storm, but human eyes can still pick up essential information that radar cannot. We want to expand the GOC to one million sky watchers at 24,000 locations.

The thirteenth source of information is also important. It is the Air Weather Service. In order to successfully assign and guide weapons, we must know the weather. For example, in order to direct an interceptor to a specific point in the sky at a specific moment to make an interception, the computer must know how the wind will affect the speed of both bomber and interceptor.

The sum total of all data from these thirteen sources, pouring into our defense system today, is staggering. And it will be even more when all expansions now in progress are completed.

All of this information must be correlated and used by the Continental Air Defense Command—which we call CONAD. CONAD Headquarters, located in Colorado Springs, directs our entire continental air defense. It is a joint command. This means that applicable portions of the Army, Navy, Air Force, and Marines have been combined together under one military commander. This gives CONAD direct maximum access to defensive weapons in a maximum number of places. And it pro-

vides essential unification of authority, segregation of responsibilities, and, consequently, quicker, undelayed striking power.

CONAD has the authority, when an air threat occurs, to order weapons into action. There are Air Force interceptors on alert 24 hours a day, seven days a week. Or CONAD can order interceptions by Navy planes, to the extent of their availability, from carriers or shore stations. Army anti-aircraft guns or missiles can be used.

Simultaneously with ordering weapons, CONAD will alert the Federal Civil Defense authorities, the Federal Communications Commission, and the Civil Aeronautics Administration. Liaison representatives of each of these agencies are members of the battle staffs at each defense sector headquarters. To insure that civilian planning is complete, up-to-the-minute, and feasible, these agencies maintain continuous close contact with activities at CONAD.

Limitations in Information Handling

To be able to properly exercise such far-reaching authority, CONAD must first process and evaluate all of the air situation data. Whether the system is manual or automatic, flight plans must be compared to radar readings. All air tracks must be numbered. Information as to bearing, distance, height, and speed must be continuously fed to subsector headquarters as the aircraft is tracked. (For air defense the country is divided into subsectors.) After identification as friendly, the information is voice-telephoned to the next subsector. Only when a plane cannot be identified is the information sent on to CONAD Headquarters. Under the manual system, each of these steps is performed by some individual person. Many times one person must perform several steps. The radar operator must read a scope. Another operator plots the progress of flights on a huge plexiglass board. He may receive verbal instructions from a number of sources.

The manual system is so limited that each intercept control station can handle information from only one or two radars. To secure a picture of the air situation over a large area or even a small area, a hand-plotting job must be done at subsector headquarters based on reports from a dozen smaller stations. It is all done on a person-to-person basis.

What SAGE Can Do

Through organization and training, we have made the manual system as efficient as possible. But this is not the answer. Human capabilities are limited.

However, we felt from the very beginning—after putting many scientists to work to study the situation back in 1950—that the problems associated with mass data processing, and simultaneous control of many weapons, could be overcome. After several years' research, study, and experimentation by top-notch scientists and engineers, we believe that most of the problems have actually been solved— and that SAGE is the answer.

How the improved air defense system will operate, using the new semi-automatic devices, will be illustrated later this evening in a film called SAGE. The fundamental improvement which semi-automatic operation brings is not only greater speed but also greater accuracy, reliability, and capacity. This could never have been adequately done by manual methods. Under manual operation, the fundamental unit or building block was one radar. Under SAGE, a dozen radars can be automatically

linked together to give a much more informative and comprehensive picture of the air situation. As rapidly as the air situation changes, the composite picture in subsector headquarters will change. We can control and direct many times as many weapons as heretofore.

There are many electronics devices which will bring semi-automatic operation to air defense. The brains of SAGE is the giant electronic computer. Each sector and subsector will have one. In its memory drums many facts can be stored. As new facts develop, the memory drums can be automatically kept up to date. The computer can furnish, rapidly, solutions to complicated navigational and vectoring problems. One of its greatest benefits is its unfailing accuracy.

It can furnish a correct picture at the earliest possible moment to the subsector commander. The commander must evaluate the situation and make tactical decisions. Only a computer could assess and evaluate an air situation, in relation to location and speed of defense weapons, rapidly enough to produce the one best solution.

The semi-automatic operation of SAGE also includes a new converting device which changes radar information into a signal form whereby it can be automatically transmitted and carried over class II telephone wires. In the past, the use of telephone wires was limited to voice or teletype. This device also permits radar to function unattended, except for maintenance.

Another automatic feature of SAGE is the data link. The data link is a radio transmitter and receiver. The transmitter is on the ground and the receiver is in the airplane. This will permit the giant computer to automatically transmit weapons control and flight instructions, with all the complex coördinates and numerical readings, to direct the interceptor pilot to the enemy bomber. When an interceptor is equipped with an auto-pilot, the aircraft itself can be automatically controlled from the ground. Automatic flight control, monitored by the human pilot, is required to meet the demands for accuracy caused by jet speeds.

Need for Communications

OUR CONTINENTAL AIR DEFENSE system today is heavily dependent upon communications circuits, to tie together all elements of the continental air defense. SAGE will increase our communications needs. As the speed and complexity of weapons increase,

A typical Dew Line scene above the Arctic Circle.

Arctic airlift: Shrouded in steam from engine pre-heaters, Air Force planes take on heavy construction equipment for the Dew Line project.

the electronic ground environment required to operate them becomes more complex. And communications is an essential element of this ground environment.

Within the continental United States today we lease almost all point-to-point communications for air defense, and other domestic military operations. Our air defense communications are an integrated network.

They originate from each volunteer ground observation post, and they originate from radar stations operated to detect and track aircraft. They run through the complex of direction centers and control centers to the Continental Air Defense Headquarters. This vast web of communications covers the country from coast to coast. It is derived through leasing circuits from the commercial telephone system of the nation.

For a quarter of a century it has been a firm policy of the military services to lease communications lines from domestic commercial telephone companies. This was not always the case, however. We arrived at this policy after years of trial and experimentation with different methods and media. For example, after World War I, the military had embarked on a policy of communications by means of their own radio networks, rather than using telephone circuits. But early in the 1930's two primary reasons influenced the abandonment of that policy. First, the military services found that radio could not provide the same degree of flexibility and diversity of distribution that the domestic telephone commercial carriers could, with their extensive land line networks. Such flexibility and diversity could be duplicated by the military only at an exorbitant cost in money and manpower. Second, and equally important, was the problem of obtaining radio frequencies. They were increasingly needed by the military for overseas communications, and for other growing requirements such as the aeronautical service. Use of radio for domestic communications by the military, therefore, gave way to the leasing of commercial telephone land lines.

To provide the telephone communications required by SAGE will require the local realignment, regrouping, and augmentation of the telephone lines now utilized by air defense. But these are only the tentacles, the nerve ends we might say, in local areas throughout the United States that must be changed and augmented. The backbone of this system remains substantially unaffected.

When the concept of SAGE was developed, five years ago, one of the basic assumptions tacitly made by the scientists was that such a system was feasible in the continental United States only because of the existence of a network of commercial communications land lines that has no counterpart in any other part of the globe. Today this network, operated by the Bell System and the Independents, represents a private capital investment of nearly sixteen and a half billion dollars. Since 1945 it has been growing at a rate of one billion dollars a year. And the demand from the public for better and more extensive service indicates that this rate of growth will increase, rather than decrease, in the foreseeable future. As an assistance to national defense, particularly in the air defense aspects, the telephone system is becoming a greater national asset each year.

We have also estimated that by 1960 it may cost as much as 240 million dollars a year for leasing the communications facilities required for air defense. Normally, this cost of leasing is computed, as it is now for all our leased communications, on the basis of government tariff rates established in the public interest by the FCC and local utilities regulatory bodies. These are applicable to rental of lines by the public in general.

The engineering of leased facilities to insure compatible operation of all elements in the SAGE system is an extremely complex job. Technical standards applicable to all elements must be rigidly adhered to. The entire web of existing communications in a specific local area must be engineered as an integrated whole. Such engineering must be carried out at one focal point for the entire system, if the system is to operate effectively. This focal point is the engineering department of the A. T. & T. Company in New York City. Participating in this effort are representatives of the Associated Bell Companies and a representative of the U. S. Independent Telephone Association. We are also encouraging coördination with manufacturers who make equipment for the Independent companies.

As the engineering for each area is completed, the installation and operation of the required leased facilities will be carried out by local telephone companies in the areas in which SAGE direction and control centers are established. All companies, Associated Bell and Independents, will have an opportunity to provide the leased circuitry required for SAGE.

At present, the Air Force is leasing lines for all military purposes from about 600 telephone companies, 20 of which are Bell System and 580 are Independents. For SAGE nearly every corner of the country will be involved. Obviously, a great many telephone companies will participate. The number of companies participating cannot be predicted at this juncture. However, all the telephone companies of the nation are protected by franchises covering the areas they serve. Any company affected by SAGE will therefore have an opportunity to provide circuits required in its area. A waiver in favor of another company can be made only if the franchise holder volunteers it.

One last word about leased communications. I would like to stress that the communications lines required for SAGE will, in general, not be newly constructed in their entirety. The major portion will be derived from the vast network of commercial communications lines presently in existence. The value of these new extensions lies in the fact that they will be engineered and built to integrate with the over-all telephone system of the country. Only by this can we get the quality, flexibility, and reliability of service required.

The Navy's newest Early Warning radar blimp.

I would also like to stress that we are counting on teamwork and support of this program from all parts of our vast telephone system, including the many equipment manufacturers which serve that system. Our experiences in the past indicate clearly that such teamwork will be readily available. Also our specific discussions with both Bell System people and representatives of the Independent Telephone Association indicate that the service we need for SAGE will be provided.

A Specific Definition of SAGE

BEFORE TURNING TO OUR PROGRAM for implementing SAGE, I would like now to give you the specific definition of this project as we use it in our daily work.

The SAGE System is that portion of the air defense system that provides the means for the semi-automatic processing of data and weapons control. It consists of:

a) Facilities to transmit air surveillance data from data-gathering sources to Direction Centers.

b) Direction Centers, where air surveillance data is evaluated and developed into air situations, and from which weapons assignment and guidance is generated.

c) Facilities to transmit situation data from Direction Centers to Combat Centers.

d) Combat Centers, where data is evaluated and developed into broad sector situations, from which weapons resources can be monitored.

e) Facilities to transmit instructions from Combat Centers to Direction Centers.

f) Facilities to transmit the instructions from Direction Centers to users such as CAA, FCDA, and various weapons units.

You can see that the heart of the SAGE project is the direction center building which houses the computer and the "black boxes" which feed information to it. A second major part of SAGE is the leased communications circuits which connect the rest of the air defense activities to the computer building. The third and much smaller part of the project is the equipment at the radar or other sites which convert the raw data into a form which the leased circuits can handle.

The equipment at each subsector for the most part will be housed in a concrete blockhouse building, which must all be especially constructed for this purpose. It will be windowless, must be air-conditioned for technical reasons, have special heat-dissipation equipment; besides, it must have special lighting and special dehumidifiers. Each blockhouse will cost about $3¾ million. In addition, each one must have an ancillary power building. The power building, however, will not have the technical requirements of the main building and will cost much less.

Radar equipped Air Force planes patrol hundreds of miles off shore.

Our biggest problem in SAGE, next to devising and testing the system itself, is the problem of successfully building, engineering, and installing the equipment. A basic requirement, of course, is that the finished product will have a high level of operational reliability.

There are several types of complex electronic equipment in SAGE. Three have already been mentioned: the computer, the radar converter, and the data link. There also is monitoring equipment which continuously checks on unattended radar miles and miles away to see that it is functioning properly. At the radar sites, special equipment will automatically transmit the converted radar data over telephone lines. And there are many other lesser equipments both at the radar site and at the control center. The coördination of these equipments is a major engineering feat.

The Air Force has been confronted with similar tasks in our aircraft and missile programs. As many of you already know, we have solved them by applying what we call weapons system management. This type of management uses a major contractor to coördinate and integrate the engineering and production details of the complete aircraft or missile. For example, we have used this method in the B–52 with Boeing as the systems contractor and in the F–102 with Convair. Now for the first time we are using the weapons systems approach to a major ground supporting system. We have selected a weapons systems contractor for SAGE—that contractor is the Western Electric Company. However, it is really the total resources of the Bell System we are hiring for this purpose; Western Electric is merely the contracting agent, as is the case customarily in contracts involving the Bell System.

Now, using a weapons system contractor does not mean that other companies do not take part in the program. Actually, the major items of equipment, which dollar-wise represent the most significant portion of the SAGE system, are procured from several other manufacturers on prime Air Force contracts. In addition to this, many, many subcontractors share in the job of building equipment for SAGE. A good proportion of these subcontractors fall into the category of small business. In addition, the large task of erecting the specialized building for the computer will be contracted, in most cases with local construction companies under bidding procedures normally used for Air Force construction. From a purely financial point of view, it is wrong to assume that the weapons system contractor for SAGE gets a lion's share of the business. Specifically, for management services, the weapons system contractor will receive only a very minor percent of the total cost.

On the Air Force side, the SAGE project

is managed by a Joint Project Office—just as we do for aircraft projects. This office is set up in New York City and is the focal point for management of the task of building the SAGE direction centers. The Air Material Command exercises command control over this JPO—however, representatives of the Air Research and Development Command are full time members of the JPO staff. Other agencies having a vital interest in SAGE, such as CONAD and our Air Force installations representatives, are represented by full time liaison officers.

The management provided by our JPO is not just passive monitoring of the prime contractor's work. It is instead, a very active daily control of the salient points in the project. Our main purpose in using the weapons systems contractor is to help him provide the over-all integration needed in complex engineering jobs. However, we recognize the Air Force responsibility for insuring that our equipment procurements are operationally useful and obtained economically. So we provide the controls necessary for this in the JPO.

One aspect of SAGE is misunderstood frequently. Although we are leasing the communications circuits for SAGE—we are not leasing the other parts of SAGE. When the direction center building, with its computer and other equipment, are completed, they will be U. S. Government property.

LET ME EMPHASIZE, in closing, that SAGE actually is not a new air defense system. It is merely the modernizing of our existing system by introducing semi-automatic operation. This is accomplished by many electronic devices, by far the largest and most complex being the electronic computer. This computer is of such a nature that a special building with special atmospheric conditions is necessary for its adequate functioning. This building, including installed equipment, will be U. S. Government property. Over 600 separate communications lines must enter this building, tying it to many radar, to many other information sources, and to other control centers. These communications circuits will be leased from the appropriate franchise holder.

Constructing the SAGE system is one of the largest electronic ground systems we have ever attempted. The Air Force, in order to control it, has selected the weapon system type of management. This type of management has already proven successful in our aircraft and missile programs. This is the first time this type of management has been applied to a ground system. We are confident that this approach will give this country a reliable, major improvement in our air defense. And it will do it in the shortest possible time, at a minimum cost for quality workmanship.

Radar equipment mounted on a "Texas Tower" many miles at sea.

Its objectives: to help keep the public informed about the Bell System, maintain public good will toward companies and their employees, and sell our services and facilities

GETTING READY FOR THE NEW BELL SYSTEM TV PROGRAM

WILL WHITMORE

Advertising Manager, RADIO-TELEVISION-EXHIBITS, A. T. & T. CO.

Announcement has been made that the Bell System's television program will be available to TV viewers throughout the country when suitable network time can be obtained during evening hours, when the vast family audience is tuned in. The program, a weekly half-hour dramatic series, is now being filmed in Hollywood. The following article is a timely discussion not only of this new Bell System venture but of the System's important role in the television industry. EDITOR.

"WHEN IS THE BELL SYSTEM going into television?"

Is there a telephone man or woman who has neither asked nor been asked this question?

One way to answer it is to say that the Bell System has been in television since the very beginning. And the beginning? Turn back the pages of history to that fateful night of March 10, 1876. That was the night of the great transformation—a transformation that gave man a new power. That was the night seven words spoken by Alexander Graham Bell vibrated momentarily as sound waves and simultaneously were reincarnated as electrical vibrations to travel over wires and to be transformed again into sound vibrations.

When Bell said "Mr. Watson, come here, I want you," the acoustic barrier to man's words was shattered. His words could now travel on wings of electricity a few feet or many miles. The voice and ears of television had their beginning that night.

From that night on, telephone men worked and dreamed and found ways and means to better telephone service, and each step forward was a step toward television. By 1915, spoken words could span the continent. That same year, a telephone man sent his words winging not on wires but through the air from Arlington, Virginia, to the Eiffel tower. By 1922, the Bell System was operating the first commercial radio broadcasting station: WBAY, subsequently WEAF. The following year, telephone men sent a radio program over telephone wires from New York to Boston—and network radio was born.

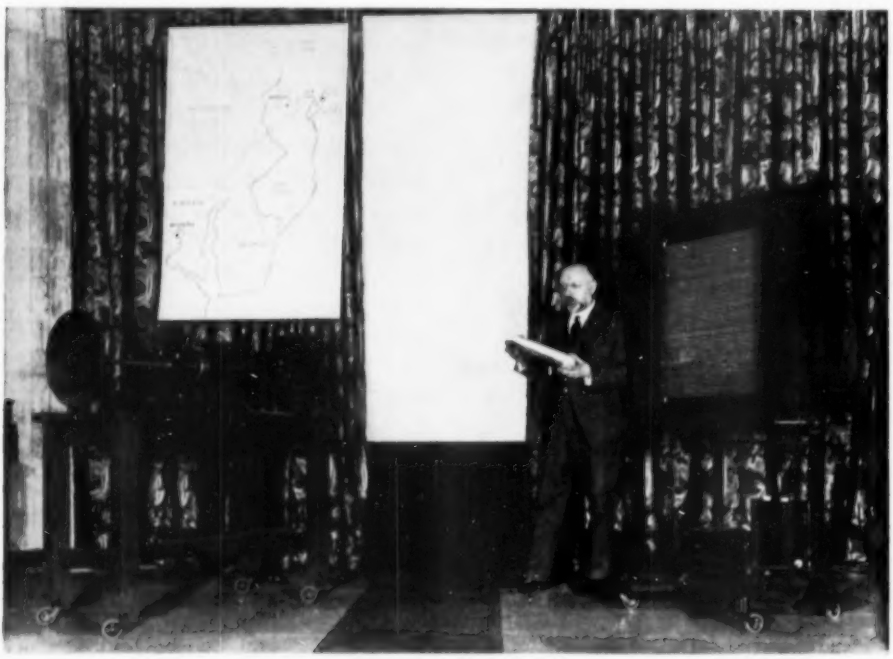
Other telephone men learned how to

send pictures over wires and now man could both "see" and hear at a distance. Two telephone men, Maxfield and McKenzie, taught the world how to record and reproduce sound electrically. This knowledge gave birth in Bell Telephone Laboratories to another great development that brought television nearer: talking motion pictures. In 1927 the Laboratories were sending television images over wires and through the air. By June, 1929, the Laboratories added natural hues to these transmitted images—color TV! A year later they were sending two-way television images over telephone wires. You saw the called person and he saw you.

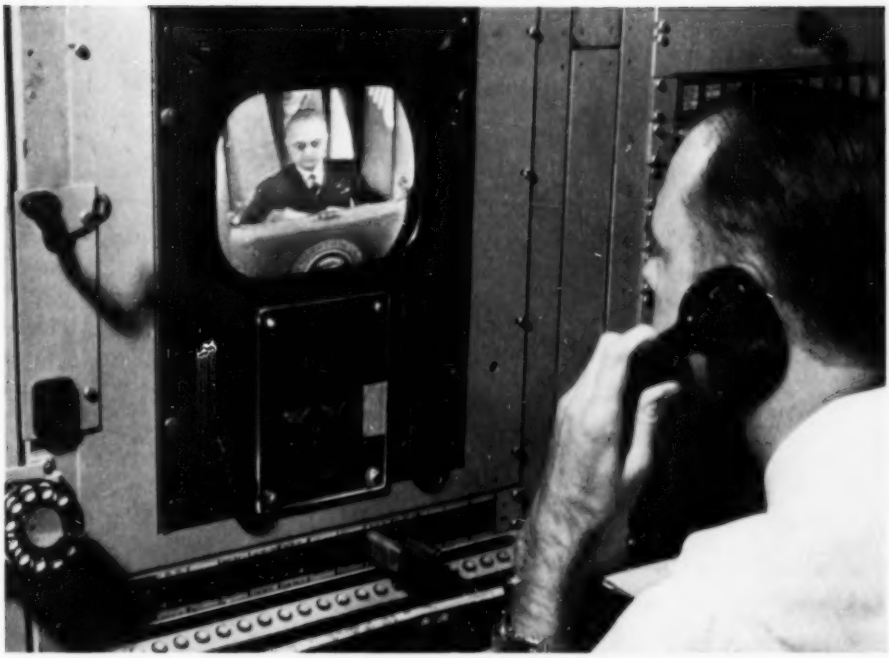
In 1938, telephone men held a public demonstration which gave promise to the one thing that would make television truly nationwide. On November 9, 1938, they sent sound motion pictures over a coaxial cable from New York to Philadelphia. The war put a stop to further developments, but with war's end, things really began to happen.

By May of 1948, commercial network television was a reality, with twelve stations in five cities interconnected by 916 channel miles of television circuits. The year before, micro-wave television circuits had been put in operation. On September 4, 1951, network television spanned the continent.

To detail all of the accomplishments by telephone people that have resulted in television as we know it today would take far more words than are contained in this MAGAZINE. Today there are more than 70,-



The late Herbert E. Ives, of the Bell Telephone Laboratories, who was in charge of the first public demonstration of television, on April 7, 1927, is shown with apparatus used on that historic occasion.



Former President Harry S. Truman is shown in a Chicago monitoring set as the Bell System brought scenes from the Japanese peace conference on September 4, 1951, to the nation's television sets in a historic first transcontinental TV transmission.

000 channel miles of television circuits criss-crossing the continuent—about 51,000 of them adapted for color—bringing network television to about 400 stations in some 265 cities. The Bell System is truly *in* television, and its job of making network television available to almost every home in America is one of the most remarkable achievements in modern technology and business enterprise.

Dotting the hill-tops of the nation with micro-wave towers and extending the coaxial cables to cities and towns provided the telephone circuits over which network television programs could flow.....thus giving to this nation the greatest medium of mass entertainment, information, education, and advertising it has ever known.

THE QUESTION IS ASKED, "When will the Bell System get into television?" It has been shown that it has been *in* from the very beginning to make network television possible. Perhaps you mean by your question, when will the System employ television as a medium of information and advertising? Here again the answer is the same. The system has been *in* television from the beginning. Bell System telephone companies began using this great new medium to inform their customers about the telephone business from the very first days of commercial television. More than half a dozen companies have or have had regular weekly programs, and all Bell companies now use television to inform or to sell.

In 1947, when television was still being

Just before the order "Action!" Showing how toll dialing works, as part of a "call by number" telephone company commercial.

called an infant industry, a half million people saw Bell System motion pictures on television. This television audience to Bell films sky-rocketed to more than 200 million for the first six months of 1955. During the same period, Bell System people stood before television cameras to deliver more than 200 talks, demonstrations, and news items to an audience of over 40 million home viewers.

In 1950 the Bell System sponsored a half-hour Christmas television program called "The Spirit of Christmas." Bell telephone companies have sponsored it every year since then. Each year, it has entranced millions of children, and grown-ups too. Its message of "peace on earth, good will toward men" has enhanced the good will which people everywhere hold for telephone men and women, as attested by the many letters which come to telephone companies each Christmas time. Here is a telephone company program that has already become a Christmas television classic.

In the first six months of 1955, the associated companies placed and paid for more than 16,000 commercial messages on television stations. They were used to promote the use of the classified directory, to sell additional telephones in the home, to promote greater use of Long Distance, to indicate to Long Distance callers the advantages of calling by number, to show subscribers how to use the telephone more efficiently, and to strengthen their convictions regarding the high value and low cost of their telephone service.

Telephone companies today use television in almost every conceivable effective fashion to increase the public's knowledge about their operations. Closed-circuit television to permit citizens of a small town to witness a cut-over from manual to dial operation, television to educate the public

on how to dial; television news on film furnished to TV stations to acquaint the public with new developments in telephony; television "spots" to sell color telephones as Christmas gifts. Whatever is new about telephone equipment, services, telephone people, or telephone research, you can be sure the public is hearing about it over their local television stations.

BUT YOU STILL ASK when the Bell System is going to get into television—and by that you mean, when is the System going to sponsor a regular network entertainment television program just as it has sponsored its own network radio program, The Telephone Hour, for more than 15 years?

That is a question that no one can answer as this is being written—but it may have been answered before you read this. The answer is imminent, and intriguing to telephone people. This much can be said. The Associated Companies are sponsoring a weekly half-hour television program; the program has been selected and is now in production on motion picture film; and you will see it on your own television screen in your own home just as soon as suitable time can be arranged for its showing on one of the networks.

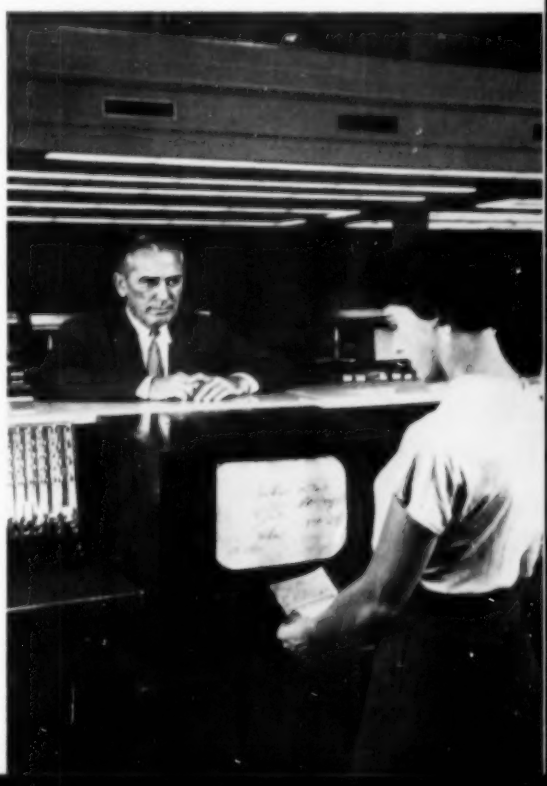
What will this program be? Before that could be answered, much work had to be done and many decisions made. Finding the right television vehicle to carry the telephone story to a nation of telephone users has been no easy job. What kind of program would *you* select?

Of one thing perhaps all telephone men and women could be sure. The Bell System network television program, representing all of the Associated Companies and all of its people, must reflect the character and personality of the System.

It should be a welcome guest in anyone's home. It should be suitable for the eyes and ears of a child to see and hear. It must appeal to, rather than offend, the taste of that child's mother and father or his grandmother and grandfather. It should appeal to the young and old of both sexes; to the high school student and the college graduate. It must be a program of universal interest, because the telephone is of universal use and the program must deliver the telephone story to all those who use the telephone and to those few who don't.

Perhaps most important of all, the program must appeal to those who provide telephone service....the seven hundred and fifty thousand men and women of the Bell System. Any program worth considering should have a better than fair chance

Closed-circuit television is being used increasingly in business and industry. Here a teller in a branch bank is comparing a signature with the record in another office.



of being liked and enjoyed by them. They must be proud of it . . . proud enough not only to look at it but to have that proprietary feeling toward it which makes one want to talk about it to friends and neighbors.

This was a big order! In the Bell System there are more than 205,000 women under the age of 25. There are 486,000 men and women under 35, and 264,000 men and women over 35. There are 177,000 Pioneers —which means that they have had at least 21 years of service. Truly, if a program could be found that would receive the stamp of approval from these groups, that would be all that could be hoped for it.

As the search for the *right* program continued from almost the very beginning of television, more than 200 programs and program ideas were viewed and analyzed. This search, at times discouraging, was nevertheless fruitful. In July of 1955 it produced a program that seemed to meet the specifications. It was shown to the Associated Companies. They liked what they saw. Contracts were signed and cameras began to turn in Hollywood. A 40-minute film description of the program was shown to the heads of the three television networks and they, too, liked the program, but by this time their program schedules for the fall and winter season were completed. There was no desirable time available. Perhaps that good time spot will bob up by the first of 1956; more likely in the spring, and most surely by next fall.

And now, what kind of program will it be?

Well, when you were a child, didn't you ask, "Daddy, tell me a story." When you heard the story, didn't you then ask, "Was that a true story, daddy?" Do we ever reach the point of neither wanting to hear nor to tell a good story? Nothing is more popular than a story—unless it be a true story. And if the true story is a story of success, the story about how some man or woman, rich or poor, young or old, fought and overcame a handicap, or rose above obstacles, then that story will catch and hold an audience.

And so the Bell System television program will present stories in dramatic form . . . stories about real flesh and blood people, little known or famous, but people who through the triumph of their own hu-

Santa Claus fills Christmas stockings as the pater familias spies from behind a chair, in the Bell System classic "The Spirit of Christmas."

man spirit rise for a moment or through a lifetime to something heroic and noble.

One story will be that of the stepmother of Abraham Lincoln, who fought for and earned the love of young Abe and his sister and perhaps gave first encouragement to him and sent him on to his destined glory.

Another will be the story of an humble junkman who rose to wealth and honor and a college degree at middle age.

There will be stories that are as modern as television itself, and others that reach back in time to tell of some little-known man who lived two hundred years ago but left his mark upon the world. Each story, whether new or old, will be told in terms of man's positive achievements rather than his defeats.

While each story will be told in dramatic form, with actors portraying the lives of the people about whom the story is told, one of the country's best story-tellers will introduce each story and narrate parts of it. He is John Nesbitt, long known in motion pictures and on radio and now making his television debut on this program.

Mr. Nesbitt is most widely known for his highly popular series of MGM motion picture "shorts," "The Passing Parade." These shorts consisted of 10-minute dramatizations of true stories. Between 1938 and 1948 about 70 of them were produced and shown in motion picture theatres throughout the United States, and many of them were translated into as many as six languages for use in Europe, Asia, and South America.

These "Passing Parade" shorts supply the best evidence of Nesbitt's unsual ability to combine high quality with great audience appeal. In five out of the ten years that the series was being produced, it won the Motion Picture Academy "Oscar" for the best short subject of the year. And in three of those years it also won the Quigley Box Office Award for the "short" that drew the largest attendance.

Nesbitt was born in Victoria, B. C., in 1910. (He was naturalized as a United States citizen in 1950.) His father was Norman Hill Nesbitt, a British educator who later became a Unitarian minister. His mother, Elizabeth Nesbitt, was an American school teacher.

His family came to the United States while he was still a boy, and he was educated in Massachusetts and California schools and attended St. Mary's College in Moroga, California.

When his father died during the depression in the early 1930's, he went to work as a laborer in the California canning industry. However, his interest in dramatics and his excellent voice soon led him into radio. After wide experience as an announcer, writer, and director, he started his own radio program, also called "The Passing Parade." This program had a long and successful history before it was discontinued in 1946. Nesbitt lives at present in Carmel, California, with his wife, Priscilla, and their four children.

Production will be under the direction of Jerry Stagg, whose varied career has included experience as advertising writer, playwright, radio announcer, and producer of both TV programs and TV plays.

So there is the Bell System television program . . . a series of weekly half-hour dramatized true stories told on film and to be presented on one of the nation's television networks. The stories are being produced in Hollywood by the Hal Roach Studios, largest producer of television programs on film and noted for the quality of its work.

Will you and your friends and neighbors like the show? No one, of course, can an-

The cast of "The Stepmother," one of the stories in the television program the Bell System is planning to present to the nation. Ronnie Lee plays young Abe Lincoln and Rita Lynn appears as his stepmother.

Here are the junkman who achieved wealth and a college degree, and his two sons, in the story "The Golden Junkman."

"The Man with a Beard" and "The Joyful Lunatic" are two more stories which have already been filmed for the Bell System television program.

swer this question until the program goes on the air and you have had an opportunity to judge for yourself.

It will not be a glittering "spectacular," but it is hoped that it will be human, honest, friendly and warm, and a welcome visitor each week in about seven million American homes. This is an honest appraisal of its character and potentialities.

It is an experiment and a year's trial should reveal not only whether the program is right for the Bell System but also much about the effectiveness of television as a medium of information and advertising for the telephone companies.

AND NOW, FINALLY, perhaps you have one more question: What does the Bell System hope to accomplish with this television program?

That is an important question, and the program's success will depend upon the way in which the question is answered.

The program will be expected to accomplish three things. It must help to keep the public informed about the Bell System. It must help to maintain the public's good will toward telephone companies and their employees. And finally, it must help in the job of selling our services and facilities.

A weekly half-hour program presented for one full year gives the sponsor just 156 minutes of "commercial" time. Considering the cost of television today, those are precious minutes. They must make plain, understandable, and appreciated the many mutual problems which exist and arise between the providers and the users of a service which contributes so much to our American way of life.

These minutes must depict the men and women who live and work in communities across the land to provide this service, and show how in their warm, courteous, and friendly manner they strive to make that service ever more valuable to the user through research, through better manufacturing methods, and through the daily operations of the telephone companies.

Some of these minutes must sell, and sell hard, the new and additional conveniences of modern telephone service in the home and office. They must "sell" mother and dad and sis and brother on the warm, human satisfaction in just a friendly telephone call to some one near and dear to them—across the street or across the nation.

Each of the "commercial" minutes, and the program itself, must contribute something toward maintaining and strengthening that public confidence which has helped so greatly to enable an aggressive and progressive telephone system and its people to provide the best possible telephone service at the lowest possible cost.

Is that too big an order? Remember, the telephone story is a big story . . . a many faceted, thrilling story of success, not unlike the stories to be delineated upon the entertainment portion of the show; but television, too, is big, and it has the power to convince and move people. When all members of a family enjoy together a television program, there is a unifying force at work which makes television's impact even stronger. When millions of families throughout the nation view a program simultaneously in all parts of the land, perhaps this same unifying force works to produce an impact the force of which no one has yet really measured.

A Guest Editorial

TO SERVE WELL, WE MUST BE FINANCIALLY STRONG

JAMES W. COOK

Vice President, REVENUE REQUIREMENTS, A. T. & T. CO.

"WITHOUT HESITATION, the telephone men formed a human chain through the raging waters . . . Again the crew formed a line, this time in even deeper and faster water. To these men, rescuing seven persons was nothing exceptional."

I'm quoting from the previous issue of this MAGAZINE. The rescues mentioned took place last August near the telephone office at Putnam, Connecticut, during the flood emergency. In those critical days, telephone people were similarly helpful many times, in many places, and in many ways.

Over the years, telephone men and women have matched their technical skills in meeting emergencies with an unfailing willingness to undergo personal risks to help others in distress. Helpfulness is the heart of our spirit of service, and from newest recruit to president we take pardonable pride in the record.

There are many other important elements, of course, in any emergency restoration job. Plant and engineering appraisals of damage are promptly translated into requirements for men and materials. All of us in the various departments work closely together—checking and cross-checking—to solve mutual problems. Individuals skills are reinforced by top-notch equipment. We carefully coördinate staff and field activities to achieve the best results, both for the immediate situation and for the long pull too. Finally, there is always the team drive which helps overcome even the most stubborn obstacles. The wrap-up expression is "Bell System resources."

WE TELEPHONE PEOPLE have heard this term applied many times to our prompt and effective action in coping with storms, floods, fires, earthquakes, and other disasters. To be sure, this capacity to rise to the occasion is what the public expects of us. But it's nice, too, to be appreciated. Newspapers write about it. Civic groups even pass votes of thanks.

Yet from where I sit, I see one factor among these resources which is hardly ever mentioned. And it is one of the most important. That is *financial strength*.

Let's think about it a minute.

In times of crisis, telephone men and women work long hours, willingly, doggedly, often wearily. They have a job to do and they do it.

Wire, cable, poles, batteries, and a thousand and one other items are needed in a hurry. At times, in huge quantities. They are on hand in supply houses and storage yards. Or they are manufactured in round-the-clock shifts and rushed by fastest means to the point of need.

You do almost anything to restore service in an emergency.

A helicopter flies plant men to an isolated community. A ninety-car train takes men and trucks from the mid-West to New England. Thousands of vehicles travel the highways to help get service back as quickly as possible. It all means food and housing for the men, gas and oil for the cars, materials galore to do the restoration job.

The major disasters of 1954 and 1955 did more than $30,000,000 of telephone damage. All this destruction was caused by such mild sounding hurricane ladies as Carol, Edna, Hazel, Connie, and Diane, and by floods. It's obvious that the shortness of the service interruption—the speedy return to normal—could only have been accomplished by telephone companies that are financially strong.

IT'S EASY TO DRAMATIZE what financial strength means during an emergency. But what it means from day to day, *all* the time, is even more important and far reaching.

For instance, it takes money to pay for research. Without it the telephone art would be in the horse and buggy stage. But with it, and largely because of it, the American people enjoy more and better communication services than any other nation. Customers, employees, and share owners all benefit from Bell System research.

The customer benefits from new and more valuable services—and also from efficiencies made possible by better methods of providing them. New inventions make the services continuously more useful. Economies put the telephone within reach of all.

Good jobs, better tools, and safer work-

ing conditions—these too result from good earnings. Only the prospering business can grow. And it's always the business that prospers and grows that offers the most opportunities for advancement.

The share owner, too, gains from the same improvements that benefit customers and employees. His investment in the business is more adequately protected as the System expands the range and usefulness of its services.

Good earnings permit the long range approach to the problems which vitally affect the best interests of all three groups. Providing plant is a case in point. Experience has shown that it's good business to anticipate future requirements and provide for them in part in earlier installations. It takes some extra money at the time but, looking ahead, it's the wise thing to do.

We need the financial resources and security to plan and build most wisely for the future. Our business is growing rapidly and as we expand we are constantly building improvements and economies into the service.

Clearly, our basic strength lies in good earnings which are the product of adequate rates. Every one of us can help in making sure we keep that strength.

Research into future needs and desires of the American public is a big job, to which all units of the Bell System can make constructive contributions

LEARNING WHAT TELEPHONE SERVICE PEOPLE WILL NEED

JOHN M. SHAW

Assistant Vice President, MERCHANDISING DEPARTMENT, A. T. & T. CO.

"IT IS OUR DESIRE not only to keep abreast of the public's telephone needs at all times but also to anticipate those needs just as much as we can." So said President Cleo F. Craig to the A. T. & T. share owners at their annual meeting last Spring. A new Merchandising Department has been created to advise and assist in the job of meeting that desire.

Can we anticipate what the public expects of us with more assurance, and with more advance notice, than has hitherto been possible? The new department has been addressing itself to this question.

Many of the skills needed already exist among us. We have had long experience in forecasting community growth, and in expressing this growth in terms of physical requirements. Much has been learned about the forecasting of population and economic trends as a basis for planning the future. The theory of sampling has had many applications. Techniques for measuring public attitudes have made great advances since the war. Customer preference studies have been a part of our scientific research work. The science of appraising markets for goods and services has also moved forward, and its methods are either well-known to telephone people or are readily available from outside sources.

Thus it is clear that what is commonly known as "market research" is not a new thing in Bell System operations. If we are to come closer to anticipating public needs, it would seem that renewed emphasis and coördination of existing skills will be more likely to provide the answer than any new or revolutionary program.

The Accounting Departments throughout the Bell System have assumed responsibilitiy for the job of gathering together, at the request of other departments, all the pertinent market information that these skills and techniques can provide. They are strengthening their statistical divisions for this purpose. But research really begins when the facts are known. The interpretation of the facts so as to appraise correctly their significance to our objective constitutes a job that must be done by all departments.

"It is our desire not only to keep abreast of the public's telephone needs at all times but also to anticipate those needs just as much as we can," said President Cleo F. Craig to A. T. & T. share owners at last Spring's annual meeting.

Looking back ten years

A NECESSARY GUIDE for the future is the experience of the past.

When we came out of the war in 1945, the hope and expectation was that we would catch up in a year or two with the war-built backlog. Neither we nor anyone else could foresee ten years of uninterrupted and rapid growth.

What happened is eloquently told in a few simple statistics:

Bell System	*1945*	*1954*	*% Increase*
Telephone conversations (Billions)	29.9	52.7	76
Telephones (Millions)	22.4	43.3	93
Operating revenues (Billions)	$1.9	$4.8	153
Investment in plant (Billions)	$5.7	$14.1	147

This post-war record of growth is all the more remarkable when we reflect that it was achieved in spite of the difficulty of anticipating with assurance the future market for our services. Nothing in our history offered a parallel to what happened after the war. Large and record-breaking as were our capital and construction programs, we still had not fully achieved the goal of giving the public what it wants when it wants it.

The first question that confronts those who are concerned with market research is therefore this: Are there signs and portents, based on our 1945–1955 experience, which will help us to anticipate what the public may want and need between now and 1965?

There are such signs and portents. And it becomes, therefore, the first job of market research to search them out and read them as carefully as possible. The statistical divisions of our Accounting Departments keep constant watch over population and economic trends and make the results of their studies available. It remains for all depart-

The experimental bedroom telephone is designed for attractiveness, lightness, and convenience.

This is a non-operating model of a bedroom telephone currently being market tested in aqua blue, rose pink, beige, and white.

ments, with the help of market research, to interpret these forecasts in the light of their own operations.

Looking ahead ten years

FOR THE BELL SYSTEM as a whole, here is what the statisticians tell us about the next decade:

Bell System	*1954*	*1965*	*% Increase*
Telephone conversations (Billions)	52.7	75	42
Telephones (Millions)	43.3	68	57

Expressing these increases in terms of revenues and investment is more complex because these are affected by technological and dollar-value trends that are more difficult to foresee. But that there will be substantial growth in these items seems inevitable.

In interpreting these forecasts, we must bear in mind that the statisticians base their future predictions on what is known of the past. We must also contemplate the effects of new services and methods, as well as the influence that aggressive promotion would have on the final result. This would mean increasing the 1965 estimate by some substantial but as yet unknown percentage. The application of market research techniques can give us a more complete picture of what the public will expect of us in ten years.

What are we measuring?

WHAT WE NEED TO MEASURE is the market for the use of a variety of communication services, local and nation-wide, with connection to the world outside. This is, after all, what we are selling.

In order to assure a high quality of service, it is necessary that we provide and maintain certain terminal facilities, chief among which are telephones and teletypewriters.

Important as is this equipment that the customer uses, the extent of it is ultimately dependent on the extent to which the customers want or need to use it. If we measure aright this need to use our services, we must then fit the facilities to that use. If we wish to expand the market, we must encourage existing uses and create new ones. The terminal facilities must be readily available, efficient, and pleasant to use—but always they are the means to the end and not the end in themselves.

Community market measurement

THE TELEPHONE NEEDS of the nation are the sum of the telephone needs of all its communities.

The telephone people who serve the local community are in best position to know the needs of the people who live there. They are in touch with its leaders in all walks of life. They know best in what directions the town is growing, what the plans are for new housing, and what industrial plants are expanding or being newly built.

Yet despite this local knowledge, the rapid growth of 1945–1955 has seen the capacity of many a newly-built central office exceeded early in its service life. Promotional programs have had to be curtailed so as not to sell party-line users more single-

line service than our new buildings had lines for.

We have learned by such examples that behind the expressed demand of which our held orders for new and higher-grade service are so eloquent, there is an unexpressed demand that, having defied exact measurement, has not been fully reflected in the estimates on which construction of new central offices in many instances has been based. It is our hope that modern market research techniques can help us to come closer to the ideal situation where the capacity of our physical plant is at all times sufficient to the needs of the community yet not so far in excess of these needs as to be wastefully overbuilt.

We need also another kind of market research aid that must come to the local management from outside. When one of our large industrial customers, in anticipation of a growing market for its products, lays its plans to spend a billion dollars in new factories, it does not at first know in what communities this investment will be made. Nor do Bell System people know in what communities we will be called upon to serve these new factories or assembly plants. But we do know that they will be somewhere and that they will increase the public need for telephone service. Anticipating public need is therefore not entirely a local community job, but the market knowledge of local management must be supplemented by that of people on headquarters staffs.

"The public greeted the introduction of color telephones with unexpected enthusiasm."

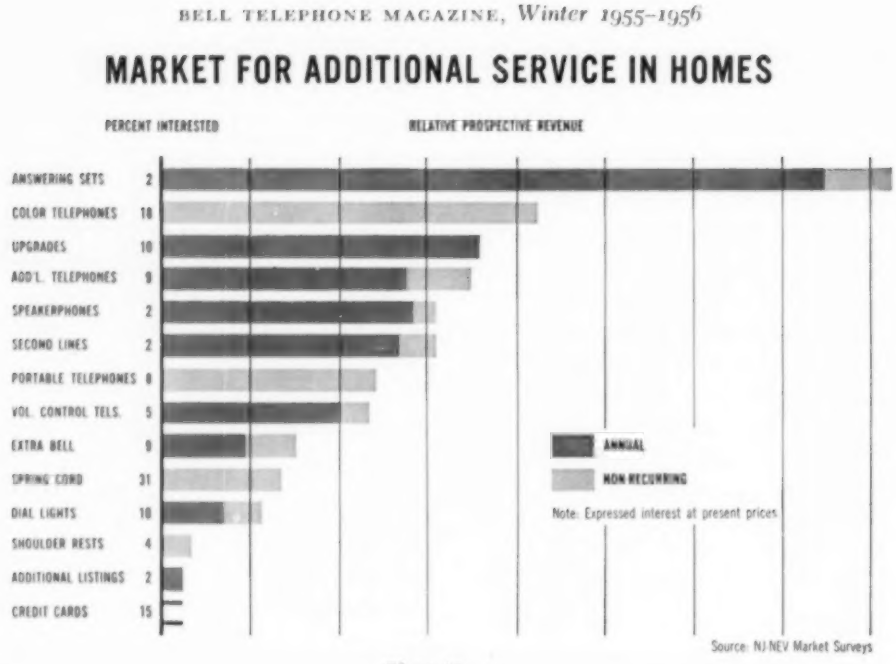


Chart No. 1.

The home telephone market

THERE IS CONSIDERABLE EVIDENCE pointing to a market for home telephone service beyond that reflected in the statistical estimate. In 1945, only 47 per cent of American homes had telephones, and this has increased to 72 per cent at the present time. Of these telephone homes, some 14 per cent have two telephones and a minute percentage have three or more. The statisticians estimate that about 83 per cent of the homes will have telephones in 1965—about 62 million home telephones in all.

Market studies made during 1955 in New Jersey and Nevada help us to anticipate the public need for fifteen home telephone services now offered.* Since the results in these widely separated and diverse territories correlate quite closely, it is not unreasonable to assume that they may be roughly representative of the nation-wide market that awaits development.

Effect of color on the home telephone market

THE PUBLIC GREETED the introduction of color telephones with such unexpected enthusiasm that it was decided to conduct a nation-wide market study to determine what colors would prove most acceptable and to what extent the customers would want them at current prices. This entailed visits to 6,000 homes in 75 cities, so selected that they would be representative of the more than 27 million homes served by the Bell System. By expanding the results on a Bell System basis we find that there is a ready market for about ten million color telephones. Further application of these same techniques can enable the companies to anticipate public demand so as to keep

* See Chart 1, above.

supplies and promotional activities in better balance than is otherwise possible.

The study has also given us precise information about the living spaces where telephones are now chiefly located in the homes of America. It is quite clear also that color taste goes by rooms: light pastel shades in the bedroom, grays and greens in the living room, whites, reds and yellows in the kitchen. Should the time come that there are more telephones in bedrooms than in living rooms, the leader would presumably be rose pink. Our color requirements would change accordingly.

This may very well be the situation long before 1965 is reached. Not only are there more than 70 million bedrooms in homes served by the Bell System, but there is now under consideration a telephone especially styled for bedroom use with particular thought to its aesthetic appeal. Non-operating models of this entirely new telephone, shown on pages 249 and 250, will be made up in the preferred bedroom colors and market-tested by the same method used in the nation-wide color study.

What our study of the home market so far tells us is that the American public is ready to accept a new concept of home telephone service. It used to be that one standard black telephone centrally located and listed in the directory was all that was needed. That is no longer true. The home of the future will have telephones in all its principal living spaces, and these telephones will be styled to the needs and colored to the taste of its occupants. It remains for the Bell System to so direct its market research, design, manufacturing, advertising, selling and installation programs that we shall be in advance of this trend, guiding it. We shall do that, of

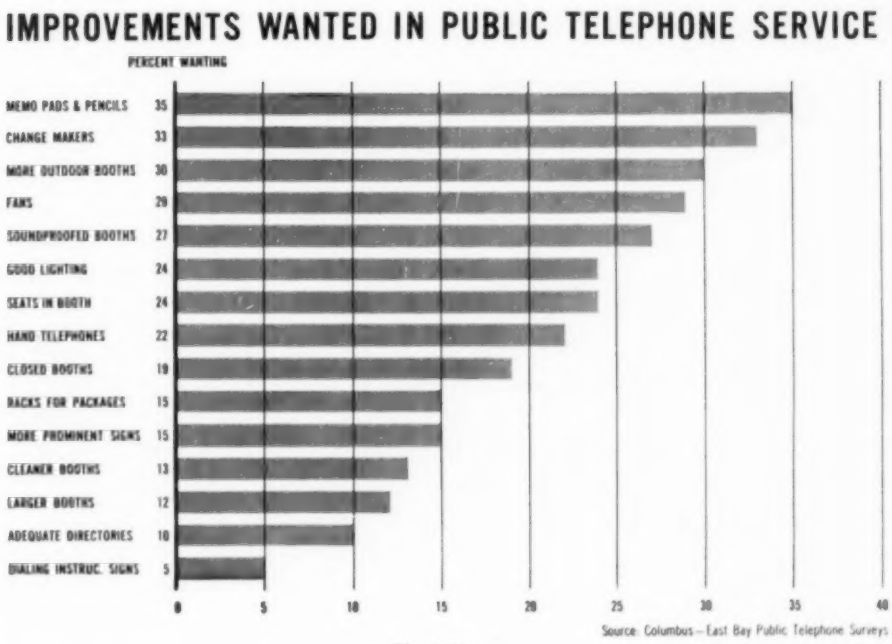

IMPROVEMENTS WANTED IN PUBLIC TELEPHONE SERVICE
PERCENT WANTING
MEMO PADS & PENCILS 35
CHANGE MAKERS 33
MORE OUTDOOR BOOTHS 30
FANS 29
SOUNDPROOFED BOOTHS 27
GOOD LIGHTING 24
SEATS IN BOOTH 24
HAND TELEPHONES 22
CLOSED BOOTHS 19
RACKS FOR PACKAGES 15
MORE PROMINENT SIGNS 15
CLEANER BOOTHS 13
LARGER BOOTHS 12
ADEQUATE DIRECTORIES 10
DIALING INSTRUC. SIGNS 5
0 5 10 15 20 25 30 35 40
Source: Columbus – East Bay Public Telephone Surveys

Chart No. 2.

course. Otherwise we shall be behind it, for the trend seems inevitable.

The business market

TO ANTICIPATE AND KEEP ABREAST of the needs of our business market is a much more complicated process than to do the same for the home market. Yet the basic problems and the approach to them are quite similar.

Communications needs vary in accordance with the nature of a business, making it desirable to study separately each of a considerable number of business categories. Recognizing this, the Commercial Department of A. T. & T. has suggested that each associated company select for specific study one or more business categories that might be of especial importance in its territory.

The first of these studies is under way. Its purpose will be to examine into the needs of the downtown department stores and their suburban branches, as they are now and as they are likely to be in the future. The operations of each department of the modern retail store will be studied to see where our existing services might be applied to serve it better or what further services we should develop. The requirements of manufacturers and distributors who are in constant communication with the store will not be overlooked. The study will include market research to find out as much as possible about the telephone's place in the shopping habits of the city dwellers and suburbanities. The entire project is one of interdepartmental cooperation, supported by outside professional help as mentioned in the introduction of this article.

Closed-circuit color television introduced the first "flowers-by-telephone" sales meeting among the nation's florists, which the telephone companies developed last Fall.

This telephone is in the granary of an Iowa farm—one of a group of farms on which the value of more complete telephone service is being demonstrated and the need tested.

When the study is completed, it is hoped that it will provide basic information that will be helpful in every Bell System city where similar conditions prevail. It should serve also as a useful and practical guide to the Engineering and other departments of A. T. & T. and to the Bell Telephone Laboratories in determining future technical research and development programs.

A study of similar nature is being considered for the railroad field. The telephone companies are working to provide America's railroad systems with communications that are in keeping with the railroads' own ideas about up-to-date service, supplemented by our knowledge of what lies ahead in the way of technical advancement. This means study not only of the railroads' own operations as they touch on communications; it means also an examination into the viewpoints and habits of the shippers and passengers who communicate with the railroads.

It is expected that market research of like scope will shortly be under way in the airline and trucking industries. While these have elements that resemble those of the railroads, they have their own distinctive elements too, and each must be examined with an understanding knowledge of its operations as they are affected by communications.

A ready measure of the importance of the railroads as a market for the use of the Bell System services is, as in the case of the department stores, the revenues that come

A need being met: A built-in light illuminates the dial of this telephone whenever the handset is lifted.

to us annually from this source, and those that they influence by the very fact of their operations. Apply the same reasoning to the hotels, the banks, the large manufacturing industries, and a score of other categories of large customers, and the scope of the market research job that remains ahead of us in the business field becomes apparent.

THERE IS ANOTHER IMPORTANT AREA of industry that it has been our custom to refer to as "the small business market." This includes the retail shops and services that we find in every residential neighborhood —the grocers, the laundries, the hardware stores, the drugstores. While composed of small individual units, these not only group themselves into large categories, but in this modern age we find them organized into territorial and national chain systems that rival in size many of those enterprises called "big business."

The communications needs of the neighborhood grocer differ from those of the florist next door. Yet they are quite similar to those of all other grocers, whether in Portland, Maine, or in Portland, Oregon.

Telephone market research will therefore direct itself to each of these giant categories. In the case of the grocer, it follows the chain of food distribution from the factory—yes, even from the field and the orchard—to the wholesale distributor, to the corner store, to the customer who places the order from her kitchen telephone. We must keep our communications services geared to the needs of each of these links in the chain of distribution, promoting their use and thus speeding up the process of food distribution.

The modern supermarket has grown at a rapid rate during the very years when home telephone service has become wellnigh universal, and almost every variety of food has been so packaged that little is to be gained by seeing it before it is bought. All the modern housewife has to do is to sit by her telephone, dial a number, give her order, and go about her business until her groceries are delivered. But instead, she takes an hour or more out of her busy day, drives a 200-horse-power automobile a mile or more in the rain through busy traffic, finds a parking space, walks to the store, pushes a small carriage up and down the crowded aisles, selects gaily colored packages from the shelves, stands in line at the cash counter, carries her purchases to the car, drives home, and deposits her bundles in her telephone-equipped kitchen.

Market research in this field would put a measure on the extent of this merchandising opportunity, and on the telephone usage that we stand to stimulate by promoting our service as a fast and economical

final link in the communications chain that brings food from field to kitchen.

The neighborhood florist is a member of a business fraternity so big that we have estimated that our current "flowers by telephone" promotion can mean $6,000,000 a year in long distance revenue. Yet this is only part of the telephone's potential use in the distribution of flowers from the nursery to the table.

In each of these business enterprises, and in all others that are parts of America's great and growing distribution system, market research is needed to help us keep abreast of the communications needs of these customers, and to continuously direct our program of laboratory development in accordance with these needs.

Besides these studies directed to measuring public need in home and business, we need to examine certain broad areas of telephone service in which market research projects have already been started or are being considered by various companies. A brief description of three of these is all that is possible in the brief compass of this article.

Public telephone service

THE PUBLIC TELEPHONE, which in years gone by was "the poor man's telephone," is now every man's telephone while he is away from home. More than six per cent of all Bell System revenues come through this channel.

Improvements in the appointments, appearance, and location of public telephones since the war have taught us that the public rewards such attentions to its comfort by ever-greater use of these facilities. Outdoor booths in city after city have brought in more revenue than the nearby indoor booths without lessening the latters' revenue. When booths in the New York subways were brightly painted, their use increased substantially.

Such results naturally lead us to ask what other improvements might be made. Surveys of public needs and desires conducted in various states gave us a partial answer, as shown in Chart 2, on page 253.

These studies covered the field of public telephones over wide areas. We know, however, that each of the improvements, and perhaps others, has greater significance in some locations than in others. We need to examine these needs more intensely, and by types of location—the railroad terminal, the drugstore, the gasoline service station.

Information services

THERE IS A VERY GREAT but as yet unmeasured desire for services which enable large numbers of people to make regular calls to common numbers for the kind of infor-

Talking "no hands." This gentleman is conversing through the speakerphone—which can also be used in the customary fashion.

mation that can be magnetically recorded on a repetitive basis.

Time service is now provided in this way in many Bell System cities, and millions of calls are made daily just to find out the correct time. A brief weather report is similarly provided in twelve metropolitan areas and 85,000 people call for it every day in New York alone.

Since what we are selling is the use of a communications system, we will strive for the expansion of these services until they are available wherever they can be economically provided so that their use becomes in time a universal habit.

There have been numerous requests for information services of a similar nature—stock exchange quotations, news reports, sports results, daily menus, and a host of others. Some of these requests it has been possible to meet, particularly since we have been in position to install recording-answering equipment on customer premises. In some cases these services have stimulated so much traffic as to overtax the capacity of our central offices.

Market research is needed to determine the extent of the desire for each of these services, not only to help us determine whether they should be provided, but also to serve as a guide to the Laboratories, where the instrumentalities are developed.

Telephone number availability

NO TELEPHONE CALL can be made without a number. If our objective is to expand the use of our service, we will therefore do everything possible to make telephone numbers readily available to the users.

The graphic arts have not improved rapidly enough to keep pace with the physical expansion in listing information as the number of telephones has increased. Directories have consequently grown larger and more cumbersome, and it has been necessary to split them apart to serve smaller areas at the very time that the dialing range is expanded. Meantime, inviting advances have been made in microfilm, magnetic recording, television, and other allied fields that provide a glimmer of hope for a future method of number dissemination that would supplement the time-honored method of printing in black ink on white paper.

Studies are under way in the Laboratories looking to new methods of providing number information. As a guide to those studies, we need to know as much as possible about the habits of the telephone users in the finding and recording of telephone numbers. Market research, in this as in other ways, should keep pace with applied research in the physical sciences.

IN THE SPACE OF A brief article of this nature, it is possible only to touch the high spots of so comprehensive an undertaking as the anticipating of the needs and desires of the American people for communications service.

It is a big job. But it is one that will be done because each operating unit in the Bell System is undertaking that part of the job which it is best equipped to do. The skills are already in the telephone organization or can be availed of on the outside. Since the will to do it is also there, it is merely a matter of time until we are in position to anticipate fully and keep abreast of the public's telephone needs at all times.

Minutes of the National Telephone Exchange Association for 1880–1890, in the A. T. & T. Historical Library, disclose hopes and problems of the Founding Fathers

CONFERENCES ARE AN OLD BELL SYSTEM CUSTOM

RALPH E. MOONEY

Historical Librarian, A. T. & T. CO.

WE DID NOT originate business conferences. As an institution, they probably were begun by the earliest traders along the shores of the Mediterranean or the China Sea. Nevertheless, most of us feel that Bell conferences have a special quality, and possibly we are right. It does seem that national and local, departmental and interdepartmental gatherings have a more important place with us than in many other industries. They figure largely in our management and training programs, and in the merchandising of our end product, telephone service.

Perhaps this is because the value of conferences became apparent early in our history. For "system-wide" meetings were being held when the Bell System itself was more a conjecture than a fact. They took place under the auspices of an organization named "National Telephone Exchange Association," which held twelve meetings at intervals during the years 1880–1890 inclusive. Printed transcripts of the proceedings at each meeting survive today in the A. T. & T. Historical Library. By direct statement and between the lines they afford a valuable record of the development of telephone service throughout those early years.

Alexander Graham Bell got his first patent on March 7, 1876, when his telephone would transmit speech sounds but rarely words. On March 10, it transmitted the oft-quoted sentence, "Mr. Watson, come here, I want you!" In 1877, Bell took out his second basic patent, and his assistant, Thomas A. Watson, began to develop commercial telephones. Beginning in April, these were rented for private line use, and in many cities agents were licensed to promote telephone usage as best they could. By October between two and three thousand telephones had been rented.

In 1878 came the first telephone exchanges, and with them the first efforts at competition in our business. Growth and competition filled the latter part of 1878 and eleven months of 1879. Then it became apparent that no other means of transmitting the voice had been developed that would not infringe upon the Bell patents. Competition ceased for a time, and the founders and licensees of Bell telephones

Morris F. Tyler when he was president of the Southern New England Telephone Company.

had before them the task of consolidating the infant local and long distance services that had shared in the struggle to get started. And nine to ten months later, September 9 and 10, 1880, the first "national convention of telephone companies" met at Niagara Falls to organize the National Telephone Exchange Association.

Enthusiastic Uncertainty

To get a general impression of the work of the Association during its early years, it seems worth while to move ahead to September 1885, when Morris F. Tyler, president of the Southern New England Telephone Company, was stepping down after serving two years as president of the Association. In a valedictory speech, he undertook to review telephone affairs from the beginning.

"I remember very well," he said, "when we came together in 1880, all strangers to one another. I don't think there were three men in that gathering that I had ever seen before except the American Bell agents. We were all in a state of enthusiastic uncertainity."

Elaborating this, Tyler went on to assert that no one at the first meeting in 1880 could say his exchange was making money and back the statement with figures. No one even could say he expected to make money and offer figures to support his estimate. A year later, there was a more definite basis for optimism. Two major threats in patent litigation had been decided in favor of Bell, and business generally was good. Therefore, in the years 1881–1882: "I think I saw the most self-contented men . . . that ever came together in one room."

Complacence, then as now, could not long endure. The meetings of 1883 and 1884 were much less cheerful, for the country was in the grip of a depression. Finally, 1885 found things on the mend, but Tyler warned: "We have reached the period of steady work, of constant anxiety, of careful forecastings not only of tomorrow, but of next year."

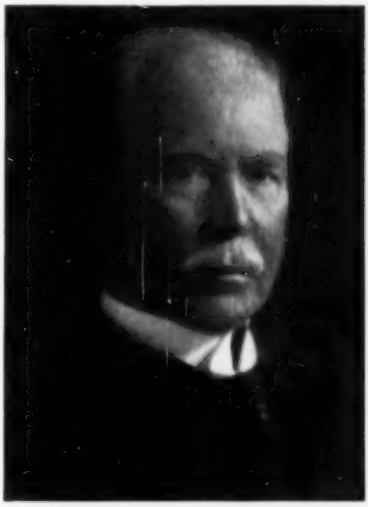
Suggestions, Not Commands

Another quotation from the 1885 meeting is in order here. During a discussion as to whether the Association should go on record as favoring one of three proposed gauge scales for wire, someone asked if such an action would bind all members to use the scale selected. Charles N. Fay, of the Chicago Telephone Company, one of the ablest of early telephone operating men, said: "When that question first arose, it was generally accepted that the intent of the Association was to exercise influence rather than to pass binding laws."

The enthusiastic uncertainty of the 1880 meeting is indicated in the rather limited discussion of methods and materials that

took place. The merits of galvanized as compared with plain iron wire were set forth. Lead-covered cable was mentioned, but except where a few under-river crossings were being tried, the only cables in use were not much more than a city block long, so the subject did not merit real discussion. Someone said, in passing, that occasional industries might want to operate their own switchboards, but what was envisioned was a private communication system, not a PBX connected to an exchange. Also it was taken as a matter of course that exchanges would maintain messenger services and that these might be used on contract to distribute circulars and do other non-telephonic work.

Rates, as you might expect, were a matter of moment, and all agreed that the flat charge with which service had been launched had its disadvantages; that some way should be found to get subscribers to pay in proportion as they used the service.



Charles Norman Fay, who represented the Chicago Telephone Company.

True Conference Pioneers

GEORGE F. DURANT, GENERAL MANAGER for the Bell Telephone Company of Missouri, was the first Bell System conferee—or at any rate the first on record—to say: "I didn't mean for us to take action now. I just threw out the idea as a suggestion to the convention." Sydney C. Lumbard, of the Fort Wayne, Indiana, Telephone Exchange was first to voice a common complaint. When it came time for him to talk—toward the close of a rather limited agenda, at that—he announced that previous speakers had covered everything he meant to say.

The first meeting was notable for one statement of "parent company" policy. This came up when members urged that local exchanges be permitted to take action against infringers of the Bell patent in their territories. O. E. Madden, superintendent of agencies for the American Bell Company, quickly pointed out that for local companies to undertake this would result in an endless confusion of legal actions and decisions.

The Association held two meetings the second year, 1881, and at the first of these we find John I. Sabin, of the Pacific Bell Telephone Company, noting with some surprise that as subscribers to his exchange doubled in number, his plant had to be doubled in size. A few discussions taken at random from meetings that year and the next will make clear some of the growth pains and pangs of the telephone art.

The Whisper Test

ALTHOUGH EACH MEMBER of the Association had plenty of problems in maintaining local service, all were interested in extending their lines. Therefore the question of how to get the best results over long lines

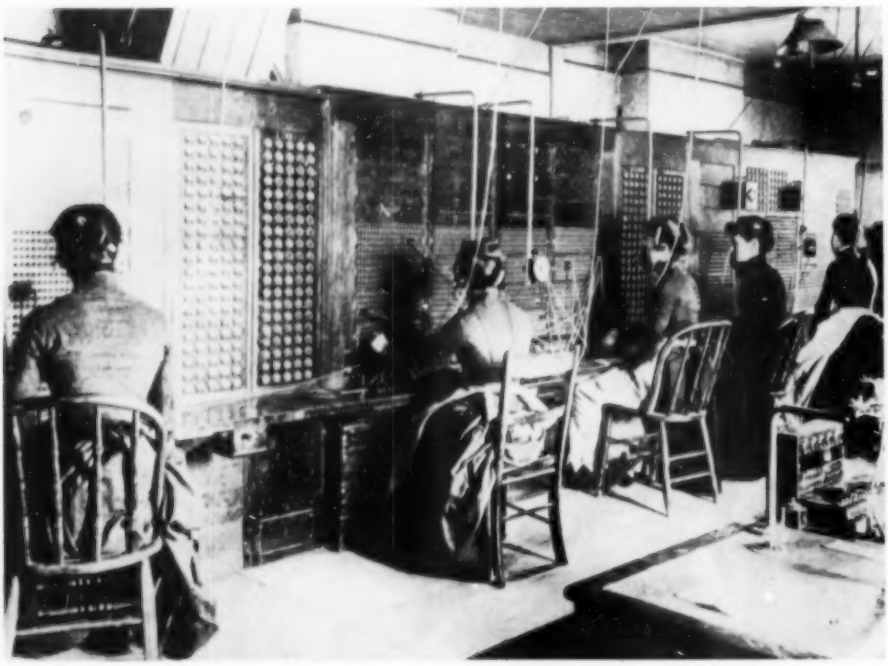
agitated them in 1881 and 1882. And one question, incredible as it may seem today, was debated at several meetings: was insulation worth the trouble and expense it caused? And by insulation was meant, not the use of insulated wire on open lines, but the installation of glass or other type of insulators and tying the wires to them. Some maintained this was wasted effort.

E. S. Babcock, Jr., of Evansville, Indiana, said, for instance: "I don't know anything about electricity and don't want to know. I have four hundred miles up that way [with and without insulators on the same poles] and you cannot distinguish an insulated from an uninsulated wire; if you listen, you cannot tell on which one is the talking."

To this, W. H. Eckert, of New York, who had been advocating use of insulators, plus a device he described as a lightning arrester and induction killer, answered: "I think we can work about two hundred miles, and to Hamilton you can whisper any time during the day."

Babcock retorted: "We have whispered a distance of twenty miles with no insulators on at all."

One reason for this early doubt of the value of insulators was the enthusiastic uncertainty that existed as to how they should be made and installed. Some were placed on top of cross arms or brackets as they are today; others hung underneath. Some were simple porcelain knobs with no provision for a dry space to prevent electrons escaping over the surface during rain or



An early multiple switchboard.

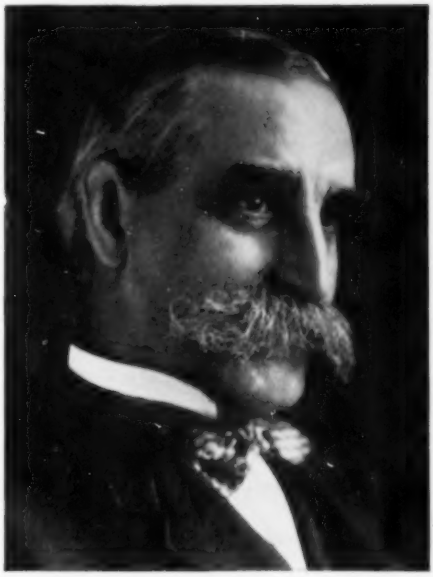
fog. Former telegraphers who had switched over to the telephone business understood the principles of good line construction, but since many kinds of troubles interfered with telephone talk, there was so much room for doubt that a man who didn't want to know anything about electricity could still argue from the results he got under good weather or otherwise exceptional conditions.

The Carbon Button

TELEPHONE TRANSMITTERS have been so good for such a long while that few people are aware they had to pass through the period of evolution common to all human devices. Bell's first transmitter worked on the principle of moving a metal armature over the poles of an electromagnet. Edison, Berliner, and Blake all contributed to working out a design that transmitted talk by varying the pressure on a piece of carbon—a carbon button. Later it was discovered that the best results were obtained with granulated carbon—grains of anthracite coal, to be exact—but in the early '80's the carbon button represented the best component to be found. And so we find one member of the Association (not otherwise identified in the transcript) saying:

"I discovered a few days ago that by reversing the battery on one of my transmitters, it worked much better. It may be that a sharp point forms on the diaphragm or spring, which by turning the current in the other direction is removed."

Commenting on this, W. D. Sargent, of Philadelphia, said that in his exchange the difficulty was "a sort of booming sound which our inspectors attribute to the springs, which are softer than in former transmitters. And we have demonstrated that is so by taking out the new springs and replacing them with springs out of damaged transmitters."



George F. Durant, who was general manager of the Bell Telephone Company of Missouri until 1909.

C. E. Chinnock, of the Metropolitan Company in New York City, then said: "I notice that the carbon as it comes from the factory has a very fine dust on it. All these fine particles make for the point of contact and fuse there. If this carbon is taken out and polished on another piece of carbon, the trouble will entirely disappear."

Early Wire Lines

ANYONE FAMILIAR with the terminology used by American advertisers and cataloguers until long after the beginning of this century will enjoy a reminiscent smile over W. A. Jackson, mainstay of telephone service in Detroit, telling the 1882 meeting to be sure to use wire of either the "Best Best" or "Extra Best Best" grades.

Soon after Jackson spoke on that occa-

Outside plant on lower Broadway, New York, in the early 1880s.

sion, a committee brought in a recommendation for reducing electrical disturbances on telephone lines, as follows: "With a well-insulated, joint-soldered line of non-magnetic material a degree of perfection may be attained that will leave but little to be desired." Which elicited comment from T. D. Lockwood, electrical and patent expert for the American Bell Company: "I think that a most excellent suggestion, but I do not see the way clear for us to get such metal, because it is one of the most important features about electricity that when any conductor, iron, steel or phosphor bronze, is traversed by an electric current, it becomes magnetic."

We should bear in mind that telephone wire at this time meant telephone line—for the lines were nearly all single-wires. This was standard telegraph construction and few telephone men had considered any other method. But the value of circuits using two wires, such as are common today, was known and even in this year of 1882 we find C. N. Fay saying: "I have been so satisfied with the necessity of using a metallic (or two-wire) circuit eventually that we are now buying cables to replace the present aerial house-top lines within what we call the business district of the city of Chicago, comprising from fifteen to seventeen hundred of our exchange subscribers." (Elsewhere in Fay's report, Chicago subscribers were reported as 2,596 total that year).

The size of wire, particularly on long lines, was a matter for debate. Fay in 1883 was for thick, low-resistance copper wire, but others held out for smaller gauge wire. This controversy was well summed up by A. S. Hibbard, then superintendent of the Wisconsin Telephone Company, in a paper read at an 1885 meeting.

Induction And Long Distance

"Our first ideas about long distance were too sanguine," Hibbard reported, "but it is now generally profitable and flourishing over distances around 100 miles." He went on to describe the toll-ticket plan for build-

ing longer lines. Books of tickets, each good for so many calls over the projected line, were sold to potential users, to help defray the construction cost. The plan was effective in building much of the early long distance network.

"Soon after construction," Hibbard went on, "came reports of mysterious noises heard in the telephone. At one end of the country the croaking of bullfrogs and singing of birds made serious disturbances, while in another locality it was held that the interferences were caused by the sighing and moaning of the wind. After a while the term *frying-pan noises* was adopted. By whatever name, these still remain the most perplexing feature of long-line work."

In dry, cold weather, the lines were practically free of the noises, but in warm, damp weather the sounds often could blot out conversation just as static can override AM radio programs today. But static to members of the Association was just the name for one kind of electricity. No one suspected it of affecting telephone lines and few were aware of the witchery of condensed water vapor for creating ghostly effects.

"It is almost impossible," reported Hibbard, "to obtain any definite information in regard to these troubles or their remedies. It has been remarked that the laws of inductive disturbance are not similar in any two states."

Another surprise in long-line work, he said, was that when two wires were strung on one line of poles, the inductive effect from one to the other was so great as to make it impossible to talk on both at once. "As yet, no satisfactory remedy for the trouble has been found. It is thought, however, that a minimum effect in cross-talk is obtained where one line is attached to glasses, well insulated, and the other attached to a bare pin or bracket. Opinions differ on this."

Hibbard then quoted a speaker at an earlier meeting of the Association as say-

A social outing of the National Telephone Exchange Association.

ing, "It has been proven conclusively that the best wire for long lines is that of the smallest diameter and of lowest resistance." He went on, presumably with a chuckle, to say, "Soon after that conclusion was reached, hard-drawn copper wire was perfected and introduced. The best results which have been obtained in long distance have been over this hard-drawn copper wire of large diameter."

The Question of Cable

AS EACH MEETING CONVENED, the question of cable became of more importance. Cable was not a telephone invention. Sir Charles Wheatstone had patented a cable for telegraph lines in 1860. The telephone companies, as they required it, at first tried telegraph cable, but immediately had to begin experimenting with various kinds of insulation inside the sheath to prevent crosstalk and induction. The best insulation and sheathing were not developed until the early 90's, after the Telephone Exchange Association had ceased to be, but the development was based on the experimenting and reports of Association members.

It may be of interest to remark that T. D. Lockwood, in 1882, described a Western Electric cable that appears to be a forerunner of the pre-lashed cable that company is supplying today. Lockwood said: "The cables are provided outside the lead tubing with a pair of stout iron wires which are twisted in a long spiral around the tube and bound to it by a smaller wire. The two stout wires are attached to all necessary supports."

Final Meeting

AVAILABLE RECORDS do not make clear just when it was decided to abandon the Telephone Exchange Association. But the reports of the final meetings furnish evidence that it had served its purpose. It had been a tremendous help in getting the telephone

John I. Sabin, of the Pacific Bell Telephone Company, and Edward J. Hall, of A. T. & T., were important figures in the telephone's second decade.

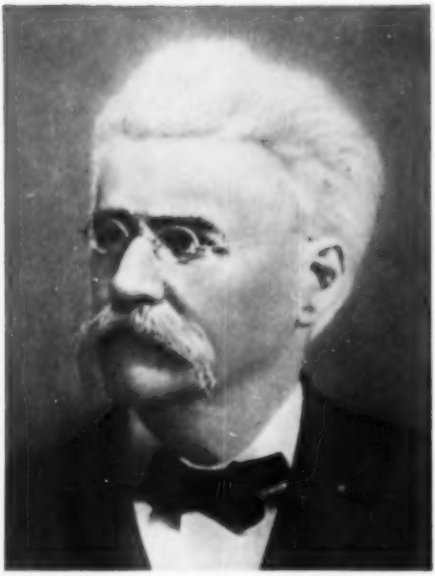
service launched and on its feet. The kind of reports furnished at the final meeting, in September, 1890, indicate that future development would be through departmental work and that future conferences, to be effective, should be confined in the main to departmental groups.

At that last meeting, for instance, E. J. Hall, Jr., who had graduated from management of the Buffalo exchange to a System position, and J. J. Carty, who was in process of taking the same step upward, displayed charts of departmental organizations, and reported on the desirability of defining authority for department heads. In addition, Carty reported on his bridging bells, which cut the bell magnets out of talking circuits to improve party-line service. George Davison, of Brooklyn, reported on the operation of a switchboard recently changed over from single-wire to metallic circuit operation. W. R. Patterson, who figured largely in developing the process for applying the lead sheath to cables, reported on the housing and care of central office apparatus. F. A. Pickernell, before long to be chief engineer of the A. T. & T. Co., reported on exchange construction and equipment.

Several companies had dropped out of the Association by that time, so that not all reported their figures for the last meeting, but those reporting listed 71,220 subscribers in 24 companies, serving 47 exchanges. Boston then reported 3,767 subscribers; Cleveland, 2,613; Hartford, 745; Louisville, 2,183; New York, 8,224; Philadelphia, 2,-901; Pittsburgh, 3,433; Providence, 2,166; Washington, 1,600. Springfield, Illinois, had the highest telephone development, one telephone to every 41 inhabitants. The westernmost exchanges reporting were Omaha (1,513 telephones: 134,000 population) and San Antonio (515 telephones, 40,000 population).

Daily calls per subscriber were reported.

Angus Hibbard—seated at right—with the original drawing of the Blue Bell, which he designed.



Charles H. Haskins, who was first president of the Milwaukee and the Wisconsin telephone companies.

Richmond was high with 17.1; Peoria next with 14.7; Toledo next with 13.2 and Hartford was low with an average of 4 per day. Peoria was high in the number of connections per operator per day average, with 1,340. Trunk toll lines out of East Saginaw were averaging 89 connections a day; those out of Richmond but 5.

Valedictory

WILLIAM D. SARGENT, of Brooklyn, was the last president of the Association. In a speech in 1890, he summed up the work of the organization—and the growth of telephony—although he gives no evidence that he was aware it was to be the final summing up for that group:

"Ten years ago, how crude the business was! The multiple switchboard was a mere idea. Cables were only hinted at. Use of iron or steel wires was almost universal. Insulation was considered of little account by many, and some declared insulators superfluous.

"The standard today requires the use of copper for conductors, overhead as well as underground, and substitution of metallic circuits for single grounded wires. The underground wires and cables of five years ago do not answer the requirements of today and the same may be said of central office and substation equipments."

And a little later, during that final meeting, we find E. J. Hall, Jr., remarking an improvement in relations between corporations in general and the public. "This change is due to better understanding [by corporate managers] of the obligations which rest on them to so organize their forces that the public shall be efficiently served, stockholders receive proper returns, and last but by no means least, that employees shall be justly compensated and fairly treated." Which, in the light of our present understanding, seems to be about the earliest expression on record of Bell System policy as we know it today.

A central office in a small city in the 1880s.

How Western Electric helped produce the ADams 3 and 4 Central Office in Belleville is in essence the story of Western's part in central office projects of all kinds

CREATION OF A CENTRAL OFFICE: A CASE HISTORY

GEORGE B. TURRELL JR.

Feature Editor, WE MAGAZINE, WESTERN ELECTRIC COMPANY

AT EXACTLY 1:01 A.M. Central Standard Time on Sunday, October 2, 1955, the "ADams 3 and 4" dial central office was cut into service in a new telephone building in Belleville, Illinois, a community of about 30,000 situated 20 miles southeast of St. Louis, Missouri.

The cut-over itself was routine—just as everyone really expected it to be. The tension in the knot of telephone engineers gathered around the trouble recorder dissolved as the blocking tools were pulled and the new equipment came to life. Reassured by the satisfying "clickety click" of switches and the absence of "trouble tickets," the group broke up with relaxed grins.

In a few minutes the operators who had been on duty in the old manual office across the street came into the new building, headsets in hand, to take their positions on the new toll and D.S.A. board. "The board over there really lighted up a little while before you cut," a service assistant said. "We thought you had changed your mind." As the Southwestern Bell and Western Electric people who attended the cut-over went home in the early morning darkness, they looked up briefly and saw that the old manual office was dark for the first time in 43 years.

Though it happened, as is customary, at a time when most people were asleep and traffic was thus at its lowest ebb, the cut-over of the ADams office was an event of some note in Belleville. Mayor Calhoun made the first call—by Direct Distance Dialing—to the Mayor of Kansas City. The *Daily Advocate* ran a front page story proudly proclaiming the "new $3,200,000 dial center" to be the "most modern of its kind in the area." Evidence of public interest, spurred by the novelty of dialing, manifested itself in the soaring traffic load right after church that morning.

It was also a noteworthy event in the lives of people such as Sy Dietz and Charlie Swartz, Southwestern Bell equipment engineers on the project, who had lived with the job for many long months; or Fred Mareschal, local commercial man-

ager, who spearheaded an exhaustive public information campaign to familiarize people with dialing. It was a gratfying moment to Dave Youngberg, Western Electric Installation Supervisor—the completion of his first No. 5 Crossbar project.

It was the culmination of a long, exacting undertaking for many other Southwestern Bell and Western Electric people—all those who had established the present and future need for the new office, who had determined its type and size and helped it become smoothly integrated in the Bell System and in the lives of the people it serves.

It has special significance here as a study of 10,530 subscriber lines—20,000 telepeople of the Bell System address themselves to; of one of the most extraordinary examples of planning and coördination to be found anywhere—the creation and fabrication of a dial central office with associated toll facilities.

ADAMS 3 AND 4 is a No. 5 Crossbar office of 10,530 subscriber lines—20,000 telephone numbers—plus 33 positions of manual toll switchboard and associated toll terminal equipment. It provides Direct Distance Dialing and Automatic Message Accounting—all the features of the most modern dial equipment. The reason for its coming into being is the classic one of these times: the rapid and steady post-war growth of a community and the corresponding need for more service and a higher quality of service than the old manual office could supply.

Somewhat larger than the average No. 5 office, it was, like so many other current jobs, a dial conversion with associated toll equipment. And it was a "coördinated job." In other words, it had to interconnect with many different kinds of equipment, both Bell System facilities and those of connecting companies in surrounding communities. Thus, ADams 3 and 4 presents a good cross section of the factors involved in producing central office equipment of all kinds. Typically, too, it was an "E. F. and I." order, meaning that, as is usually the case on larger jobs, Western Electric would "Engineer, Furnish and Install" it. The fact that it is No. 5 Crossbar, the most advanced type, now becoming increasingly familiar and important, adds to the pertinence of this study.

In mid-September 1953, Western Electric was officially informed that Southwestern Bell, having completed Traffic and Plant studies of the area's present and future telephone needs, was tentatively planning a new central office for Belleville. It was then that the "A. N. O."—Advance Notification of Order—dated September 17, reached the hands of E. J. Hanson, service manager of Western Electric's St. Louis Distributing House. It stated generally the kind of office, the type of equipment needed, and requested a tentative date for shipment of equipment to the job site of February 12, 1955, and an installation completion date of October 22, 1955.

The A. N. O. didn't come as a surprise. Because of their close association with telephone company people through the St. Louis Distributing House and the Installation Area Headquarters, Western Electric people concerned with such projects were already aware of the job. It is vital for them to get all the information they can as far in advance as possible so that tentative planning can begin. Nevertheless, the A. N. O. was a most important step in the sequence which brings a central office from planning to completion.

While it is purely tentative, and does not commit the telephone company, the

A. N. O. provides a basis for preliminary planning and scheduling. Information it contains is valuable in the preparation of long range production estimates, for example, and in planning future installation manloads. It influences many other things, such as the purchase of raw materials and especially the contracts signed with outside suppliers for heavy power equipment, for which many months may be required for delivery. It permits actual production—the manufacture of piece parts—to begin before the order is received. It has the net effect, too, of assuring the job a place in the procession of jobs going through Western Electric's shops. For these reasons, schedules set up between Western Electric and the Bell Companies call for the delivery of the A. N. O. within a predetermined interval.

April 22, 1954, is the next significant date having to do with the Belleville job. Following standard procedures, approximately four weeks before the "order due date," the telephone company gave definite notice that it would be forthcoming. At this time, Western Electric sent a prospective schedule to Southwestern Bell listing dates which complied with those requested on the A. N. O.

By the time the Firm Order, dated 5/21/54 and containing outline specifications prepared by Southwestern Bell engineers, reached Western Electric's St. Louis Distributing House, preparations had been made for it. The job went into high gear immediately. The St. Louis service organization analyzed it to be sure all needed information was there, and sent copies to "all interested parties," including the Hawthorne and Kearny Works, principal factories involved, and the St. Louis Installation Area headquarters. It was at this point that the St. Louis House prepared the project sheet and gave the job its Western Electric identity—a number: 20686—which was to become engraved in the memories of a great many people before the job was through.

As soon as Order No. 20686 arrived at Western Electric's factories, many things started happening. Of most immediate importance was its arrival in the hands of Western Electric equipment engineers who would prepare the specifications which

Frequent conferences between Western Electric people and those of the telephone company help to maintain a necessary close liaison.

would guide the manufacturing shops and installers in making and assembling the physical "machine."

This was an undertaking which was to require some thousands of man-hours of engineering time at the hands of 15 equipment engineers at the Hawthorne Works, where the No. 5 Crossbar equipment was produced, and by 14 other engineers at the Kearny Works, source of the associated Toll equipment. This phase of the project required several months and was roughly comparable to engineering the equipment for a skyscraper, perhaps, or one of the more complex "electronic bain" computing devices, which, indeed, dial equipment resembles in many ways.

The complexity inherent in the engineering of a central office arises from the fact that, with very few exceptions, no two central offices are quite alike. Each must be "tailor made"; "created" first on paper, later in physical form to meet the needs of the specific location for which it is intended. Even though each of two No. 5 Crossbar offices, for example, will have certain basic equipment in common, these "standards" have innumerable variations or "options" in the ways in which they can be interconnected with other units. Besides this, each office will have its own special features. All this must be taken into consideration and provided for if the equipment is to fulfill its specific assignments.

It is in this respect that central office equipment differs most radically from conventional mass produced products. It is not—it cannot be, as things are now constituted—turned out in the form of identical "plug in" packages. One reason for this is that central office equipment is not a "machine" which operates independently. It is but a part of a much vaster machine—the total plant of the Bell System. *It must mesh with every other type of equipment, new and old.* It must provide for the telephone characteristics of each community—its factories, residential areas—even to such details as the number of teen-agers living there. (This latter factor affects the length of time lines are held). Since it represents a very considerable investment, it must be capable of years of service without faltering. It must be rugged while still being an altogether remarkable machine-complex which approaches an ability to "think" and "act" for itself.

Because of this special engineering, plus the staggering complexity of the equipment itself, production of central office equipment takes a long time. As Western Electric people are well aware, the engineering and production intervals for such jobs as the ADams office can seem agonizingly long—especially when, as a program planning expert put it, "Some builder plows up a potato patch and puts in a few hundred houses almost over night and the telephone company has a service problem on its hands."

HOW, THEN, can such intervals be reduced? That is a problem which Western Electric and other Bell System people have been closely studying since pre-World War II days. It is not a problem for which a dramatic solution is now possible. Yet much has been done and is now being done.

Specifically, there have been and will continue to be improvements in manufacturing techniques—the development of components such as the wire spring relay, for example, (the ADams office was one of the first equipped with these on a large scale) which eliminates time required in relay adjustment and verification.

There is also constant striving for faster, more efficient equipment engineering and

installation methods which has paid off in many ways. For example, the procedure of turning certain frames in a central office over to the telephone company for their testing in advance of the completion date shaves off days and makes possible an earlier cut-over date.

At present, large scale increases in Western Electric equipment engineering, shop, and installation forces are in progress. Recent additions to manufacturing facilities, including the purchase of a plant at Montgomery, Ill., and the leasing of a plant on Fullerton Avenue in Chicago to be used for dial equipment production, will greatly increase capacity. While these factors may not have a direct effect on indivdual job intervals, they will get more jobs under way sooner to meet present unprecedented demands.

Of course, the achievement of such increases in capacity takes time. They have to be planned well in advance so that the manufacturing facilities involved can be obtained and installed in time to meet demands. This planning is dependent on advance information from the telephone companies, which is consolidated by A. T. & T. into over-all requirements prior to the "detailing" of individual jobs.

At this writing a special "task force" of Western Electric, Bell Laboratories, and A. T. & T. representatives has met under the auspices of A. T. & T. for the express purpose of studying ways and means of reducing intervals. High hopes are held for the results of this combined effort.

IN THE ENGINEERING of Order No. 20686, the following are a few of the things that had to be considered. It had to be arranged for various classes of service, plus Automatic Message Accounting and toll and tandem switching service.

It had to be arranged for interconnections with the Step-by-Step offices in O'Fallon and Lebanon and with several other types of equipment in eight more Illinois communities. It was the toll center for all these communities as well as for eleven other towns in the area. It also had to interconnect with St. Louis CHestnut and St. Louis Toll and with a 701–A PBX to be installed in Belleville's St. Elizabeth Hospital.

Most of these outlying offices were engineered by Southwestern Bell, but adjustments had to be made in them by W. E. installers and all had to be closely coördinated with the main project by Western Electric.

The part of the job controlled by the Hawthorne Works—primarily the crossbar

Skilled hands direct each wire to its destination and proper contact on the back of the frame.

Left: Equipment engineering at Hawthorne. Right: Forming cable for a frame of crossbar equipment, which may contain many hundreds or even thousands of individual wires.

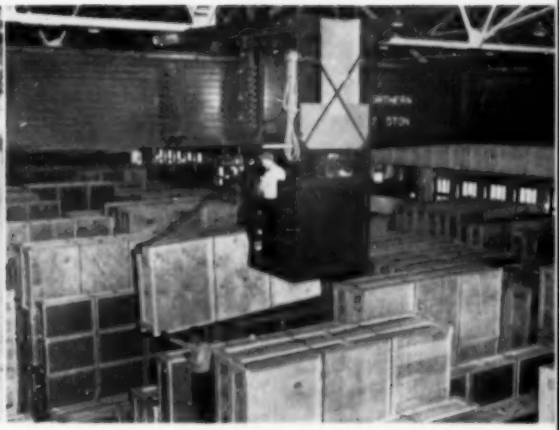
equipment—required the writing of 45 separate specifications, comprising 2950 individual, circuit, equipment, and job drawings. These specified each of hundreds of units comprising thousands of parts, plus the maze of cables and wires which would interconnect them.

This was only part of the job. The toll equipment assigned to the Kearny Works where this equipment is engineered and manufactured actually comprised two separate jobs: the 33 switchboard positions and the toll terminal equipment, all of which had to be engineered not only to work with the No. 5 Crossbar equipment but with a number of other units as well. Information on which to base the engineering for the toll terminal part of the job was not available until September 16, 1954. These jobs required another 26 specifications and 920 drawings.

Nevertheless, three weeks after engineering started, Hawthorne's first "long-hand spec" covering power equipment had been completed. A few weeks later, the first "shop specs" had been finished and the actual assembly began.

At first, order No. 20686 was without form or apparent identity in the shops. Pooled with other orders of a similar nature, it became a portion of the prodigious cascade of parts and components, of steelwork and wire, which converge on the crossbar and toll equipment shops from other shops at Hawthorne and Kearny, from other Western Electric locations, and from outside suppliers, to feed the insatiable appetites of the assembly lines.

The assembly of the components comprising dial equipment into the big frames which are its basic units, the forming of factory cables (some as thick as a man's arm and containing thousands of individual wires) which interconnect these components, is in itself an impressive undertaking. Some measure of it may be gained from the fact that just one of the 27 line link frames on order No. 20686 plus its supplementary frames required, among other things, 30 crossbar switches, 2 fuse panels, 7 jack panels, 9 terminal strips, 29 mounting plates in turn equipped with 580 relays, 110 resistances, 10 condensers, 10 contact protection networks, 6 terminal strips, 3



Left: Sections of dial equipment flow continuously through the Western Electric shops. Right: Crane operator at Hawthorne Merchandise selects the components of an order for shipment to W. E. installers.

vacuum tubes and 1800 feet of surface wiring. Interconnecting this equipment were 8 local cables comprising approximately 11,000 feet of wire. Others among the job's 286 frames contained even more.

The "tailor made" aspect of jobs such as this is a factor in the shops too. It causes variations in manufacturing processes as well as in the engineering. These require the knowing touch of trained, experienced shop people. Training people to handle "whatever comes along" on the assembly lines in itself poses a problem in these times of expansion of facilities and personnel to meet the heaviest demands for equipment Western Electric has ever had.

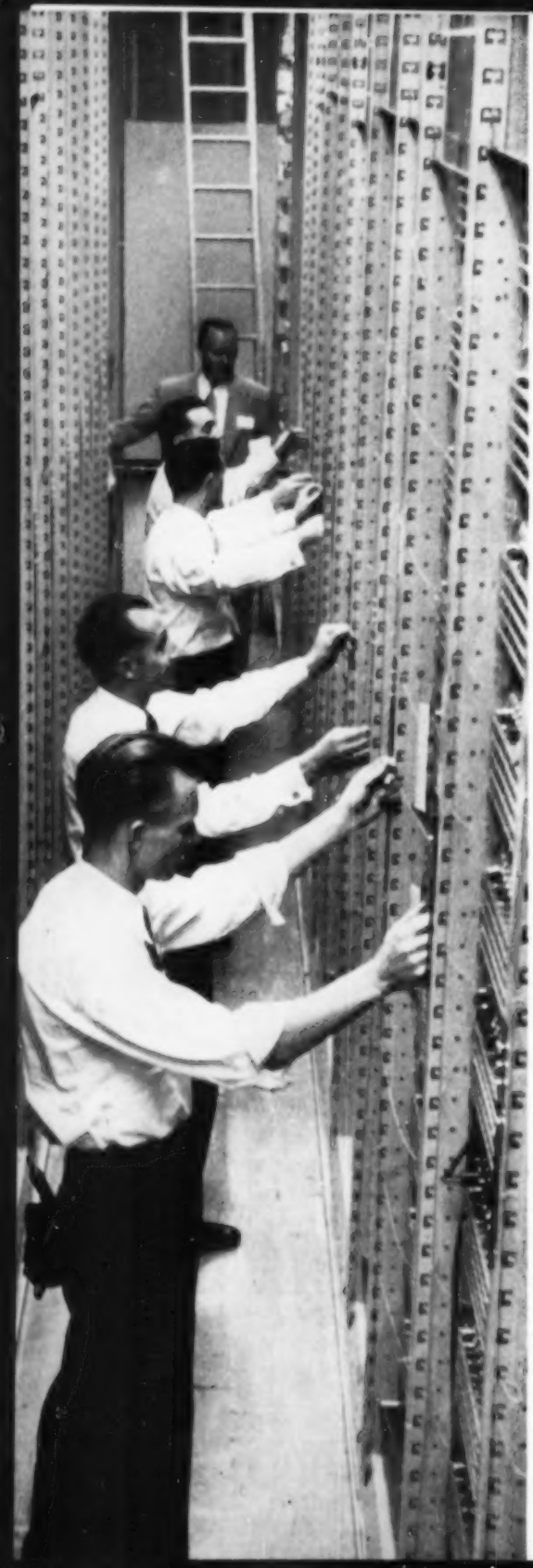
Long before the engineering interval was completed, manufacturing, too, was well under way. By late 1954, Order No. 20686 was fast growing from a miscellany of parts into final form. At Kearny, the switchboard and toll equipment was nearing completion. At Hawthorne, tall frames bearing tags on which the words "Belleville, Ill.," appeared were approaching the final stages of assembly and testing along the monorail which carries them through process after process in the Crossbar Shops.

WHILE ENGINEERING AND MANUFACTURING were in progress, a great deal of highly important "paper work" had been completed behind the scenes.

First, back in June, 1954, a study of the data in the Firm Order made it apparent that the completion date could be "improved" from the date requested, October 22, 1955, to September 24.

Second, on September 3, 1954, a series of advance completion dates were set up for iron work, superstructure, lighting, and cabling to begin on January 8, 1955, seven days after the new building was scheduled to be finished and ending on February 5. This advance work was related to the installation of the main distributing frame to be completed in advance to permit Southwestern Bell plant men to terminate cables in the new building.

The telephone company also needed Toll test board equipment ahead of time for "test board to test board" tests. Needed,



too, were two manual positions for operator training.

This meant that about 40 per cent of this part of the job had to be *completed* nine weeks ahead of time; 30 per cent six weeks ahead of time, and the rest three or four weeks in advance. Besides this, there was a lengthy list of advance completion dates to be set up for the coördinated jobs.

Shortly after the project got under way, a very important thing indeed happened as far as the Western Electric people responsible for the job were concerned. The Initial Firm Schedule—the "Brown Sheet"—was issued. Before this was done, each organization involved started at the "hind end" of the job and figured backwards to be sure they could handle their particular phase of the job in the time allotted.

When everyone was satisfied all intervals could be met, Hawthorne Scheduling prepared the sheaf of yellow paper which is the Brown Sheet. It stated flatly that order No. 20686 would be shipped on February 5, 1955, and that Western Electric installers would start work February 21, 1955—allowing for an in-transit interval. Finally, it gave the completion date of September 24, 1955. The issuance of the Brown Sheet committed Western Electric to those dates. They became, in the words of one Distributing House man, "something that's pretty sacred around here." From then onward, the Brown Sheet was law; there was nothing tentative about the job any more.

As the shipping date neared, there was another situation to be handled. The equipment for Belleville would comprise some 18 carloads—222 tons—of assorted items. Most

Climax: Preparing to pull the blocking tools, to bring the new dial equipment to instant, vibrant life.

of it would come from Hawthorne and Kearny, but not all. The Point Breeze Works in Baltimore was supplying terminal strips; wired units were coming from the Lincoln Shops; the Allentown plant was supplying electron tubes and resistors; and the Indianapolis Works, fuses and protectors, operators' headsets, and other telephones. Besides this, there were numerous shipments to be made by outside suppliers and a number of stock items (there is a consistent demand for many of these and they can thus be stockpiled) to be selected and shipped from among 22,000 such items kept on hand by Hawthorne merchandise.

The shipment of all these things had to be coördinated, and allowances made for different transit intervals from the various points. They had to be shipped in the sequence in which the installers needed them for the main job and for the coördinated jobs too, and arrivals timed to keep the job running without "flooding the floor" with too much at once. Setting up such a shipping sequence was, as usual, an undertaking which called for close cooperation between many Western Electric organizations, including Field Service, whose function is to be sure the installers get everything they need when they need it.

Field Service men live with looming completion dates, and make sure everyone else does too. Something broken or lost in shipment? Something that isn't as it should be? It is up to the Field Service men to see that such things are fixed, or replaced right away. As Jack Kole, Hawthorne Field Service man on the Belleville job, summed it up, "We go around with the Brown Sheet in our hands and we don't take *no* from anyone."

Of concern to Field Service, as they are to the Distributing House, Installation, and other Western Electric organizations, are the coördinated jobs, shipments and installation of which must be completed on schedule. "These little side jobs are a nightmare," Field Service men say. "You are always worrying that one of them will be overlooked somehow and hold up a two or three million dollar project."

Installation of the ADams 3 and 4 central office was, in the words of the men who did it, "just another job." It was "another job" requiring, among other things, the making of 750,000 wired connections, each one of which had to be perfect. It included such "details" as the moving of "C" Carrier Terminals from the old office to the new without interrupting service. It was a project in which work had to be done in many of those connecting offices and a variety of complete dates met: May 14 in the St. Louis CHestnut office, July 30 at Mascoutah and Columbia, August 13 at Freeburg, September 9 at Lebanon, to name just a few.

All in all, it was a project on which 114 Western Electric installers worked to transform those tons of inert equipment into a vast, smooth-functioning complex of machinery, tested and verified again and again to make sure it was just that.

FOR ALL ITS COMPLEXITY, for all its local importance, the ADams office is but a small fraction of the 2,500,000-plus lines of dial equipment and the 2300-odd manual positions Western Electric shipped during 1955. It was one of four similar No. 5 Crossbar jobs handled through the St. Louis Distributing House during this same period. One of about 1100 jobs big and small serviced by just this one of the 29 Western Electric Distributing Houses in a given month. It would represent an even smaller proportion of the 3,100,000 dial lines and 3420 manual positions scheduled to be shipped in 1956.

Installation work on the ADams 3 and 4 contral office was finished on September 17, a week ahead of the scheduled completion date. There followed a period of testing by Southwestern Bell. On September 28, a request for a few minor parts—eight additional 15-A indicators—came to the St. Louis Distributing House at 3:45 p.m., and they were shipped from stock immediately. "That's the last we heard from them," they say. "We believe we gave the customer what he wanted."

In a new dial office: Testing and verifying the equipment before turning it over to the telephone company.

HEADQUARTERS SUMMARY

Sept. 15 to
Dec. 15, 1955

SINGLE-CHANNEL OPERATION (Dial "Operator" only) is more desirable from the customer's standpoint than dual-channel operation, where two different codes (*e.g.*, either 0 or 110 or 211) are used to reach an operator. Two codes are used where some long distance calls (*e.g.*, short haul station-to-station calls) are handled by operators at the local office DSA switchboard and others at a separate toll office.

Recently the Companies reported on the present status of single- and dual-channel operation. About half of the total main stations in the System are served on a single-channel basis. The remaining stations are mostly in the larger cities, served by only about 100 of the total of some 2,000 toll centers. The companies' replies were in general agreement that single-channel operation is a sound long range objective.

A GROUP of experienced Commercial men and women from line and staff organizations in a number of Companies has been formed to undertake a review of the business office service representatives' job. While the service representative form of organization has proven to be efficient and practical, there have been many changes in operation since it was introduced in business offices in the early 1930's. It therefore seems timely to see if there is anything basic or fundamental that can be done to promote further job effectiveness.

The group, working in teams of two or three, will visit many of the Companies to review and discuss in the business offices the current work and assignments of service representatives. Various sizes and types of offices will be included in these schedules.

THE BUILDING construction art has advanced to the point where developers of large housing projects can now build homes and have them ready for occupancy in approximately three months. With the current shipping interval of 13 weeks for telephone feeder cables, however, it is difficult in many instances for the Companies to provide the facilities needed to furnish telephone service by the time the homes are occupied.

As an aid to correcting such situations, representatives of Western Electric and O. & E. have developed a plan whereby Western's present 13-week shipping interval on non-stock-size cables will be reduced by more than one-half for limited quantities, effective with cable shipments in April 1956.

As an important part of this plan, requirements will be furnished Western on a month-to-month basis for the fourth month ahead instead of quarterly for a six-month period, as has been the custom.

This reduction in ordering interval for an adequate part of the regular cable program, plus procedures already available for reducing engineering and construction intervals, is expected to go a long way in helping to meet promptly the demands for service in those cases where unforeseen requirements make special handling necessary.

A GREATER PROPORTION of A. T. & T. share owners subscribed to the latest offering of A. T. & T. convertibles, the 3⅜s of 1967, than in any of the Company's previous convertible offerings. Of the $637,165,800 offered, only $3,518,000 was left unsubscribed, or about one-half of one per cent. This compares with $6,140,900, or about 1%, unsubscribed in the 1953 convertible offer. The unsubscribed debentures were later sold in the market at a price of 130⅝.

Although the new debentures were not convertible before December 13th, nearly half had been converted by the end of the year. This large volume of conversions was due in part to the popularity of the "hold for conversion" privilege which was made available for the second time. Over 295,000 subscribers availed themselves of this privilege, providing about $168 million in debentures to swell the total of early conversions.

These heavy conversions on the new issue, together with conversions of previous issues and a substantial amount of equity capital coming from issuance of shares to employees, had the effect of bringing the Bell System debt ratio down from 37% at December 31, 1954 to about 35% at the end of 1955, in line with the System's long-term objective of 1/3 debt.

NEW AUTOMATIC switching equipment placed in service in Harrisburg, Pa., and Jacksonville, Fla., early in December enables long distance telephone operators in those cities to dial di-

rect to telephones in more than 4,000 cities and towns. The new mechanisms also automatically switch calls that are routed through those cities.

These installations of so-called No. 4 type switching apparatus bring to 39 the number of such systems in operation. Almost 60 per cent of all long distance calls in the United States is now handled by operator dialing. Similar facilities are now being installed for cut-over this year at Buffalo, N. Y., Columbus, O., Memphis and Nashville, Tenn., and Montreal, Canada.

A NEW semi-automatic teletypewriter relay system, the first of its kind, has been placed in service jointly by Long Lines and the Pacific Company for Consolidated Freightways, largest motor transport carrier in the West. Its purpose is to expedite messages dealing with the dispatch of Consolidated's 2,000 trucks, trailers, and other vehicles in 12 states.

A relay center at the company's headquarters in Portland, Ore., is the heart of the system. Terminated in the center are 11 circuits stretching 13,000 miles and serving 70 locations in 65 cities.

At an outlying station a message in perforated tape is placed in the transmitter. At the relay center, equipment which automatically searches for incoming messages causes the transmitter at the distant point to operate. When the message is received in tape form at the center, an attendant places it in a transmitter connected to the called station and sends it on its way by pressing the proper button. The center can also take care of "broadcast" messages. A message can be directed by push buttons to several stations on one circuit or on several circuits—or to all 70 stations simultaneously.

This is one of ten semi-automatic teletypewriter relay systems sold to date.

THE JUNCTION TRANSISTOR has made possible an entirely new approach to the design of a telephone set for the hard of hearing. Capable of operating as a high efficiency amplifier at low voltages, the junction transistor uses but a small fraction of the central office power supplied to the instrument at a customer's premises. Now for the first time it is possible to operate a practical receiving amplifier in a telephone set without the use of local batteries.

A NEW MICROWAVE ANTENNA has been developed to improve the efficiency of the Bell System's long-haul microwave radio relay systems. This antenna can operate simultaneously in the 4,000-, 6,000-, and 11,000-mc bands designated by the FCC for "common carrier" use. This antenna has already been incorporated in some recent TD–2 installations.

BULKY PRE-World War II capacitors were miniaturized first by depositing metal on thin strips of lacquered paper. Now, by a process invented at Bell Telephone Laboratories, the paper can be removed to leave only a thin film of metallized lacquer. Besides their great conservation of space, these capacitors are particularly applicable to low-voltage circuits using transistors.

UNTIL ABOUT two years ago, the use of photoelectric cells in the Bell System was largely a single application in the transmission of wirephoto pictures. However, the recent successful employment of phototransistors in the card translator unit of the nation-wide direct distance dialing network is regarded by many as the portent of more widespread general use of semiconductor photocells in communication. The latest unit of this type, the 1N85 p-n junction phototransistor, appears to be one of the most likely candidates for introduction in such new applications.

WESTERN ELECTRIC plans to move ahead with an engineering development program looking toward the substitution of aluminum for copper in the manufacture of telephone cable.

Decision to undertake this program was influenced by mounting concern over sharply rising copper prices, the disruption in production schedules which repeated copper shortages have caused, and the success of recent experiments with the use of aluminum wire. Processes being explored for quantity production involve converting facilities now used for drawing copper wire. Extent of such conversion would be dictated by future over-all economic and supply considerations. The program also includes development of means to prevent corrosion of pulp insulated aluminum conductors.

For equivalent transmission, aluminum conductors 2 gauges larger than copper are required; for example, 22 gauge aluminum versus 24 gauge copper. For underground work, this means that maximum size aluminum cable would have fewer pairs than maximum size equivalent copper cable: e.g., 909 pair 22 gauge cable versus 1,515 pair 24 gauge cable.

The Blue Pencil

HERE ENDETH VOL. XXXIV of this avowed medium of suggestion and record of progress. One hundred and thirty-four issues have rolled from the presses, beginning with that of April, 1922. It isn't 136, as a quarterly publication would imply, simply because VOL. I had only three issues and production pressure eliminated one issue during the war.

On what note shall the volume end, then? How about recognizing the increased acceptance and use of all forms of electrical communication? A pertinent reference might be to the gentleman at Weston-super-Mare, in England, who telephoned to request a reproduction of last Autumn's cover, as offered in this department then. Such time-saving method got immediate action, and a copy of the hurricane-warning scene was despatched to him the same day.

Those facts are as here stated. They ought perhaps to be amplified a bit, however, to explain that the caller didn't use commercial overseas telephone service. The gentleman is an amateur radio telephone "ham" of long practice, and for years he has conversed regularly with a colleague on this side of the water who happens to be a member of the A. T. & T. organization. When the Britisher expressed to him one morning last fall a wish to have a copy of the print of the red-and-black flags betokening hurricane, the U. S. half of the team of talkers passed along the request to the editor of the MAGAZINE—with the result already recounted.

This fuller version isn't so spectacular as the incident may have seemed at first. It is pleasant to know, even so, that the small type of these back pages really is read; and any editor would get a bang out of the knowledge that his cover design stimulated admiration in a foreign land.

Reproductions of that cover were made available to our readers, actually, with the idea that the painting might have some special significance to people who had had personal experience with the hurricanes and floods which beleaguered the north-eastern section of the country last Summer and Autumn. Where would you guess most of the requests came from? Texas and California! Don't ask us why.

Last Autumn's and this Winter's cover paintings, both done for us by Charles Mazoujian, testify to that gentleman's versatility, since they seem to possess in common chiefly the qualities of interesting concept and finished execution.

RESPONSES VARY to the minor essays which are expounded in these pages. Our tale of the outdoor telephone booth named Miranda, narrated here last Autumn, brought just some comment from a few of her more distant relatives, and an invitation to join the Marine Historical Association at Mystic, Connecticut.

Our specific request for news of readers' favorite telephone booths elicited a reminder, however, of the yarn about the booth in a hotel which appeared some years ago in Frank Case's book about the Algonquin Hotel in New York: "Tales of a Wayward Inn," published by Frederick A. Stokes Co. Do you recall it?:—

"The hotel had no elevator. Guests had to climb the stairs to their rooms, and the staff was always happy to see an inebriated stranger arrive. When he asked where the elevator was, we gravely directed him to the telephone booth. This was a huge contraption at the end of the office that might be mistaken for an elevator car if you didn't look too closely. I have seen a man sit in the telephone booth for twenty minutes, sticking his head out of the booth to holler frantically, 'Where's the elevator boy?' We always replied, in modulated tones, 'He'll be there directly, sir.' "

TEN YEARS AGO, the name of Sir Robert Watson-Watt was on every—well, almost every—tongue. He was the inventor—as much as it can be credited to any one man—of radar. And we all know that radar was what saved Britain from extinction by Hitler's bombers, and plays an incredible role today in the world's determination to remain free. Perhaps that is too much introduction to the rather minor fact that Sir Robert was arrested and fined in Canada some months ago for speeding. We wouldn't think of mentioning it if it were not that he was caught through a radar speed detector. We still wouldn't mention it, for fear of international repercussions, if it were not that we

lifted the item from the *British Post Office Magazine*.

THE WIDE OPPORTUNITY—not to say necessity—for an editor's reading we have had occasion to comment on before now. Interesting material is where you find it: almost anywhere. Most recently it has been in the *Atlantic Monthly*, which quotes a couple of chapters from a book written by John Masters and about to be published by Viking Press, called "Bugles and a Tiger: Adventures on India's Frontier." One part which struck a reminiscent note was the author's account of how as a very new and entirely untried subaltern he was suddenly given for a week the sole command of and responsibility for two whole Gurkha companies. Overwhelmed at the magnitude of the assignment, he sought the advice of a slightly senior and more experienced fellow officer. The latter recommended that the new subaltern leave most matters to the Gurkha officers and clerks, and come to him for guidance if really necessary. It was his final suggestion that the novice would find it helpful if he "always walked about at a pace slightly faster than normal, carrying a bunch of papers, and working my lips as though thinking out loud. It was good advice, and still is, and not only in the army."

We are happy to feel that we may have stumbled on the origin of a time-honored custom.

ARE WE TOO CONSCIOUS of the constant presence of the "Genius of Electricity"—the Spirit of Communication, the Golden Boy—who stands a-tiptoe overhead, swathed in cables and gold leaf, on top of A. T. & T. Headquarters at 195 Broadway in New York? Certainly we have mentioned him several times in recent issues. As a general symbol of the Bell System, he is a handy focus for employee interest. And yet he need not be taken too seriously. There are lots of jokes about him—of both kinds—and we think the one drawn on this page gives a nice little fillip to the standard representations of him.

He first appeared thus in one of the publications of the Western Electric Company. When we called up the editor, to ask permission to reproduce the idea, he said "Why don't you just do what I did?" When we asked for particulars, he said succintly: "Swipe it." So to some originator of a happy thought, our thanks.

A SHORT COURSE in relativity may be had as a concomitant to this business of editing. We spoke, a few paragraphs above, of the conclusion of 34 volumes of publication. But VOL. XXXV No. 1 is already in preparation and our sights are straining ahead to other subsequent issues. These words are being written five days before Christmas—one of the last chores before the deadline—but already it is too late to address to our gentle readers the compliments appropriate to that occasion. New Year's will have passed ere these words are read in print. But since that day lies still further ahead as they are indited, perhaps it is permissible to set down here the greeting which we hope will continue in effect for all the days, weeks, months, and *quarters* which will come to pass in 1956: HAPPY NEW YEAR.

"It's the man from the telephone company."

John M. Shaw

President of the company 1951–53. He returned to A. T. & T. in 1954, where his title is Vice President, Administration-R. And R stands for Revenues.

Born in Scotland, John M. Shaw came to this country as a boy, and was employed both in retail business and in several public utilities before joining the then Information Department of A. T. & T. in 1930. He subsequently served the Chesapeake and Potomac Telephone Company as information manager and the New York Telephone Company as an assistant vice president in the Public Relations Department before returning to A. T. & T. in 1944. From that year until the Spring of 1955, Mr. Shaw, as assistant vice president in the latter company's Public Relations Department, had charge of radio, motion picture, open house, and public lecture and exhibit activities. Last year he joined the newly

Whos' Who & What's What

(*Continued from page 215*)

which are involved—thanks to him. Mr. Cook became a telephone man in 1929, when he started as a traffic student with the New Jersey Bell Telephone Company, and in the next dozen years held various posts in that department. From 1941 to 1944 he was an engineer in the traffic division of the Department of Operation and Engineering at A. T. & T. Then he went out to the Pacific Telephone and Telegraph Company as traffic results engineer, but the following year he changed to the Public Relations Department there, as assistant vice president. The Northwestern Bell Telephone Company called him to be its Vice President of Public Relations in 1947; he was Vice President and General Manager of its Nebraska-South Dakota Area from 1949 to 1951; and Operating Vice

Ralph E. Mooney

George B. Turrell Jr.

created Merchandising Department as assistant vice president. Of his several contributions to this MAGAZINE during the past quarter century, his most recent, in the issue for Winter 1954–55, was "People as Telephone Users, Workers, and Investors."

EARLY "DOINGS" among the "founding fathers" of this business are one of the particular interests of RALPH E. MOONEY, who since 1945 has been historical librarian of the A. T. & T. Company. His telephone career began in 1924, after some years of newspaper and trade journal experience, when he joined the Public Relations Department of the Southwestern Bell Telephone Company in St. Louis. Before transferring to New York in 1944 he had been editor of the *Southwestern Telephone News*, and in recent years he has been a frequent contributor to this MAGAZINE. His most recently published article was "Thomas D. Lockwood: An Early Builder," in the issue for Winter 1954–55.

BEFORE JOINING the Public Relations organization of the Western Electric Company in 1942, GEORGE B. TURRELL Jr. had been managing editor of a "class" magazine of nation-wide prominence. After time out for the Army, he returned to Western, where he prepared material describing that company's strenuous efforts to return to a peace-time economy and perform its urgent tasks of assisting the Bell System to meet ever-mounting demands for telephone service. For the past five years Mr. Turrell has been feature editor of WE Magazine. He is able to write so authoritatively about ADams 3 and 4 because he followed its—or their—progress in person from the first gleam in the eyes of Southwestern Bell engineers until tests were completed and the equipment was handed over to those who would be responsible for it thereafter.

The Spirit of Service that keeps on growing

There is a heritage of service that is passed on from one generation of telephone people to another.

It had its beginning far back in 1875 when Alexander Graham Bell gave the world its first telephone. It has grown as the business has grown.

Many times each day and night this spirit of service is expressed in some friendly, helpful act for someone in need. The courtesy, loyalty and teamwork that telephone people put into their daily jobs are a part of it. Out of it have come the courage and inspiration that have surmounted fire and flood and storm.

We, the telephone people of today, are vested with the responsibility of carrying on this trust. It is human to make mistakes and so at times the job we do for you may not be all that we want it to be. But in the long run, we know that how we do our individual job and how we bear our individual responsibility, will determine how we fulfill our trust.

For our business is above all a business of people . . . of men and women who live and work and serve in countless communities throughout the land.

BELL TELEPHONE SYSTEM

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